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NanoVue Receiver

Version 1

Part A - User Guide

Cobham Surveillance

Commercial in Confidence

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Preface

About this Document

This document contains all relevant details required for the Operation and Administration of the **Cobham NanoVue Body Worn Receiver**.

This document contains a description of the general operations and administration aspects of the system. Since the available functions are licensed and depend on the specific implementation, not all the functions and or applications contained in this document may be relevant or applicable to the system you will be working with. Actual screen presentation may differ from the screens presented in this document due to software changes or browser configurations.

Who Should Read this Book

This document is meant for anyone interested in how the system can best be used, but it is of most benefit to:

- **Operators**, who are in charge of the daily operation of the systems and infrastructure.
- **Installation Engineers**, who are responsible for the pre-installation, on-site installation and configuration of the system in the end user environment.
- **Maintenance and Support Engineers**, who are responsible for maintaining the total system.

Assumed Knowledge

Throughout this book it is assumed that the reader has a thorough knowledge of:

- Basic Personal Computer Operations
- Basic RF

Typographic Conventions

This document uses these typographic conventions to identify text that has a special meaning:

Typographic Conventions	Examples
TEXT in small capitals represents a specific key press on the console **keyboard** or hardware **panel**.	ESC, F1, SHIFT
The + sign means “hold down the first key while pressing the second key”.	Press CTRL+C to abort
<Text> Serves as a placeholder for variable text that you will replace as appropriate to its context.	Use the filename <systemname>.sys for...
Text in **bold** emphasises a new word or term of significance.	We call this a **protocol** and its function is...
[-a] Text in these brackets indicates an optional component that can be left out.	Ls [-a]
NN This indicates a value entered on a **numeric keypad**.	45 on the numeric keypad
Successive menu selections are shown using **arrows** to indicate a sub-menu. In this example this would mean: Select the **Insert** menu, then select **picture**, then select **from file**.	**Insert " picture " from file**

Symbols

This document uses these symbols to highlight important information:

WARNING: A written notice given to a reader when a situation might result in personal injury or loss of life.

CAUTION: A written notice given when a situation might result in damage to or destruction of equipment or systems.

NOTE: A written notice given to draw the reader’s attention to something or to supply additional information.

Trademarks

All trademarks or registered trademarks that appear in this document are the property of their respective owners.

Related Documents

You may also need to read:

Document	Source
Part-B Concept Guide	Cobham Technical Communications Team
Part-C Installation Guide	Cobham Technical Communications Team
Part-D Reference Guide	Cobham Technical Communications Team

Document History

This document was written and produced by Cobham Surveillance Technical Communications Team.

This is a change controlled document. Each main page of this document displays a file name at the bottom left corner of the page. This is followed by a revision number ('R01' is the original). The revision date is also indicated in the table below.

Changes to any page will raise the revision status of the whole document.

Revision	Date	Authors	Summary of Changes
D01	2010-5-12	NH	Initial Draft
D02	2010-5-24	RDPC	Cobham Draft
D03	2010-7-6	RDPC	After JB review
R01	2010-7-6	RDPC	First Release
R02	2010-7-14	RDPC	Added battery information
R03	2010-7-28	RDPC	Update to EMC rating
R04	2010-11-23	RDPC	Update voltages and software screens
R06	2011-07-07	RDPC	Address Change

Contents

01-Systems Description

01-00 General

This chapter describes the **Cobham NanoVue Receiver** systems and controls. The functioning of components is simplified where more detailed knowledge is not necessary.

01-10 Overview

Cobham's products and services have been at the heart of sophisticated military and civil systems for more than seventy years, keeping people safe, improving communications and enhancing the capability of air, land and maritime platforms.

The group has four divisions employing more than twelve thousand people on five continents with customers and partners in over 100 countries.

01-10-01 Operational Requirement

Covert monitoring is of critical importance to protect against illegal operations. These assets can be used for detecting and catching criminals, smugglers of people, drugs, contraband or weapons and for monitoring the ever present threat of terrorism.

There has been an increasing requirement to use the rugged transmission capabilities of COFDM to carry general purpose Video, audio and data traffic.

01-10-02 Solution

Cobham Receivers use MPEG and COFDM technologies to provide robust and agile video RF links that can cope with difficult environments where direct line-of-sight is not always possible.

The Receivers feature high-quality, low latency decoding technology. All versions feature outputs for composite video signals.

You can choose from several receiver types and several transmitters to build up the perfect solution for your operation.

Receivers
NanoVue Body Worn Receiver
SOLO4 Standard Receiver
SOLO4 Broadcast Receiver
Pro-Receiver

This User Guide covers the **NanoVue Body Worn Receiver**.

01-10-03 Product Description - What is it?

The Cobham SOLO4 (and SOLO2) product range enables the user to build wireless digital microwave video systems. Cobham SOLO4 products have been designed to provide rugged point-to-point links for high quality full frame rate video and audio, even in non line of sight and urban environments.

Existing analogue systems suffer from impairments such as video noise, loss of colour information and poor image quality when line of sight cannot be maintained, and solutions based on wireless internet standards and PC platforms deliver poor quality video.

The Cobham SOLO4 system is a digital system that uses the COFDM modulation technique, which effectively eliminates the problems caused by multi-path and reflections.

The Cobham NanoVue Bodyworn Receiver is a fully portable digital diversity receiver. NanoVue incorporates a high resolution daylight viewable video touch screen with a digital diversity receiver, antennas and clip on battery pack into a robust and compact lightweight housing. It is ideal for use as a confidence or monitoring receiver for tactical use, or for surveillance on the move, perimeter security and fire control.

The product can be used with an external rechargeable clip on battery pack, providing between four and five hours battery life. The unit can also run from an external DC supply.

The user has the option to record received video to the internal SD card, for later downloading via the Ethernet port. Ethernet is also used for streaming and unit configuration.

The touch screen allows the user to switch channels and perform basic configuration without the need for connection to a PC, making it ideal for tactical mobile situations.

The NanoVue has comprehensive On Screen Display diagnostic capability to show link quality. Security of transmission is ensured by the use of optional AES128 / 256 bit encryption algorithms.

01-20 The Unique Technology - How Does It Work?

The NanoVue incorporates a powerful receiver with its own display but can also be connected to an external monitor if required. The SOLO product range has been designed to make use of many common connectors, user interfaces and mounting patterns found on your analogue products helping you to minimise your investment in transitioning to Cobham digital.

01-20-01 Receiver Functional Blocks

The receivers work in **four** distinct steps:

- Demodulate
- Decrypt
- Decode
- Digital to Analogue

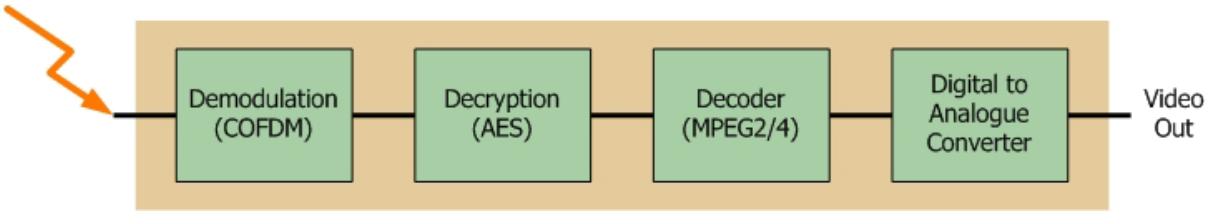


Figure 01-20-01 - Receiver Functional Blocks

01-20-02 Demodulation Block

The RF signal is first demodulated to prepare it for further processing. COFDM utilises significant redundancy, producing excellent results in high multipath environments. The data is duplicated many times during the interleaving process. Because of the interleaving and redundancy the information is presented in different carriers.

If one carrier is corrupted, it has little impact on video quality, as the data is repeated on another carrier. This provides the robustness in the system.

Digital Signal Processing on the receive side is able to recombine all this data into a single video stream.

The system supports wideband transmission at 6, 7 or 8MHz per channel using about 2000 carriers and narrow and ultra-narrow band transmission at 2.5, 1.25 MHz and 625 kHz using about four hundred carriers.

01-20-03 Decryption Block

In cryptography, **encryption** is the process of transforming information (referred to as plaintext) using an algorithm (called a cipher) to make it unreadable to anyone except those possessing special knowledge, usually referred to as a key.

The result of the process is **encrypted** information (in cryptography, referred to as cipher text). In many contexts, the word **encryption** also implicitly refers to the reverse process, **decryption** (e.g. “software for encryption” can typically also perform decryption), to make the encrypted information readable again (i.e. to make it unencrypted).

Encryption has long been used by militaries and governments to facilitate secret communication. Encryption is now commonly used in protecting information within many kinds of civilian systems.

Cobham offers ABS encryption as standard and AES-128 or AES-256 as licensed controlled option.

01-20-04 Decoder Block

The next step is to decode the digital data stream. Cobham has chosen to use the MPEG-2 and MPEG-4 standards which are mature and well-defined.

01-20-05 Digital to Analogue Convertor Block

An **analog-to-digital converter** (abbreviated **ADC**, **A/D** or **A to D**) is a device which converts continuous signals to discrete digital numbers. The reverse operation is performed by a digital-to-analog converter (**DAC**).

Typically, an ADC is an electronic device that converts an input analog voltage (or current) to a digital number proportional to the magnitude of the voltage or current.

01-30 Features and Benefits

It can be very useful to understand how the features of the unit yield tangible benefits to you. This table summarises these features and, more importantly, the benefits.

01-30-01 Features and Benefits Table

Key Features	Key Benefits
Compliant DVB-T Modulator and proprietary narrowband. Comprehensive Demodulation 8, 7, 6, 2.5, 1.25 MHz and 625 kHz.	True multi-mode operation - Perfect integration with your current equipment.
Receivers with maximum ratio combining antenna diversity as standard.	Excellent performance and reliability - Good, solid, reliable pictures that you can depend on during an operation.
High resolution 4.3” display with Day/Night Mode.	Clear images under any conditions.
Internal recording to SD card with real time clock for time and date stamping. (Available in future release of software).	Record incoming assets on a common format with date and time for evidence.
IP Streaming.	Send the received assets directly back to a remote location for observation using network infrastructure.
Integral Encryption at AES128 or AES256 (Optional).	Secure - Preserve your security of transmission with powerful, simple to operate encryption.
Line Level Audio / Video Out, Headphone output.	Easy to use - Operations staff can use standard familiar equipment.
Touch Screen and Ethernet Control Interfaces.	Use the touch screen in the field or hook up your PC back at base - Software Driven - Simple and fast to deploy and operate – saves you time and cost.
Facility for generating log files of receiver status information. (Available in future release of software).	Makes receiver management easy and simple.
Digital COFDM Modulation	Excellent performance - Resistant to multipath interference, delivers high

	quality video and audio, even when mobile or in built up areas like urban environments.
Low Delay, high quality video encoding in MPEG-2 and MPEG-4	High reliability - Use a radio system just like it was a line. You can choose between MPEG 2 and 4 to suit your operation.
Choice of L, S or C band solutions	Improved operational efficiency - Efficient use of limited radio spectrum. Choose the frequency that suits your operations. Select licence free bands for some operations. Avoid cluttered parts of the radio spectrum.
Low latency	Enables real time operations like remote vehicle control or UAV operations.
Sixteen Presets Available	Better use of assets and resources - You can preset frequencies into any of sixteen presets. Configure the whole operation in the calm of the base then the operations staff just have to quickly select the preset with one button.
High reliability and availability	Reduced maintenance requirement, reduced spares holding, resulting in significant cost benefits over the life of the system.
Low Mass	Suitable for discrete operation in the field.
On-Screen display	Software Driven - Simple and fast to deploy and operate – saves you time and cost.

01-40 Applications

The NanoVue Receiver has been designed to operate in many roles in multiple environments. Here are some examples:

01-40-01 Unidirectional Link

The NanoVue Receiver is typically used as a stand alone unidirectional video link when combined with a SOLO4 Transmitter unit.

01-40-02 Body-Worn Applications

Supplied in a rugged, lightweight weatherproof aluminium chassis, the NanoVue can be used in body-worn applications, or prolonged outdoor deployments.

01-40-03 Application List

- Tactical mobile surveillance
- Confidence monitor
- Perimeter security
- Fire control
- Major Incident Support

01-40-04 User List

- Police Technical Support Units
- Special Forces
- Security services

Note: The SOLO product range has been specifically designed for government security and law enforcement users, the equipment will tune across frequencies that are only available to licensed government users. Non-government users should employ the equipment restricted to the license exempt bands only typically 1.389 to 1.399GHz and 2.400 to 2.483GHz.

01-50 Variants

There is only **one** major variant of the NanoVue receiver:

- NanoVue Body Worn Receiver (SOL4NNV-217250)

01-50-01 NanoVue Receiver (SOL4NNV-217250)

The Cobham NanoVue Body Worn Receiver is a fully portable digital diversity receiver. NanoVue incorporates a high resolution daylight viewable video touch screen with digital diversity receiver, antennas and clip-on batteries into a robust and compact lightweight housing. It is ideal for use as a confidence or monitoring receiver for tactical use, or the NanoVue is ideal for Surveillance on the move, perimeter security and fire control.

Control is achieved through a touch screen interface or by connecting the unit to an IP network using the Ethernet interface provided.

The product can be supplied with an external rechargeable battery pack for rapid interchange which provides at least four hours continuous use battery life. It can also run from an external DC supply. NanoVue has comprehensive on screen display diagnostic capability to show link quality, enabling users to optimise transmission performance. The touch screen allows the user to switch channels and perform basic configuration like frequency selection without the need for connection to a PC.

NanoVue is ideal for tactical mobile situations providing decision makers with real time video feedback.

Security of transmission is ensured by the use of ABS encryption as standard or, for greater security, optional AES128/256 bit encryption algorithms, subject to export controls.

Figure 01-50-01 – NanoVue Body Worn Receiver

- Fully featured 8/7/6/2.5/1.25 MHz and 625 kHz demodulation
- Maximum ratio combining antenna diversity
- High resolution 4.3” display
- Easy to use touch screen for channel change
- Internal recording to SD card
- 4 hours battery life
- Optional removable battery pack with internal charger circuit
- Compact weatherproof housing

Note: NanoVue receivers are frequency specific because they have internal down converters.

01-60 System Diagrams

It can be useful to get an overview of the system diagram.

01-60-01 Main System Diagram

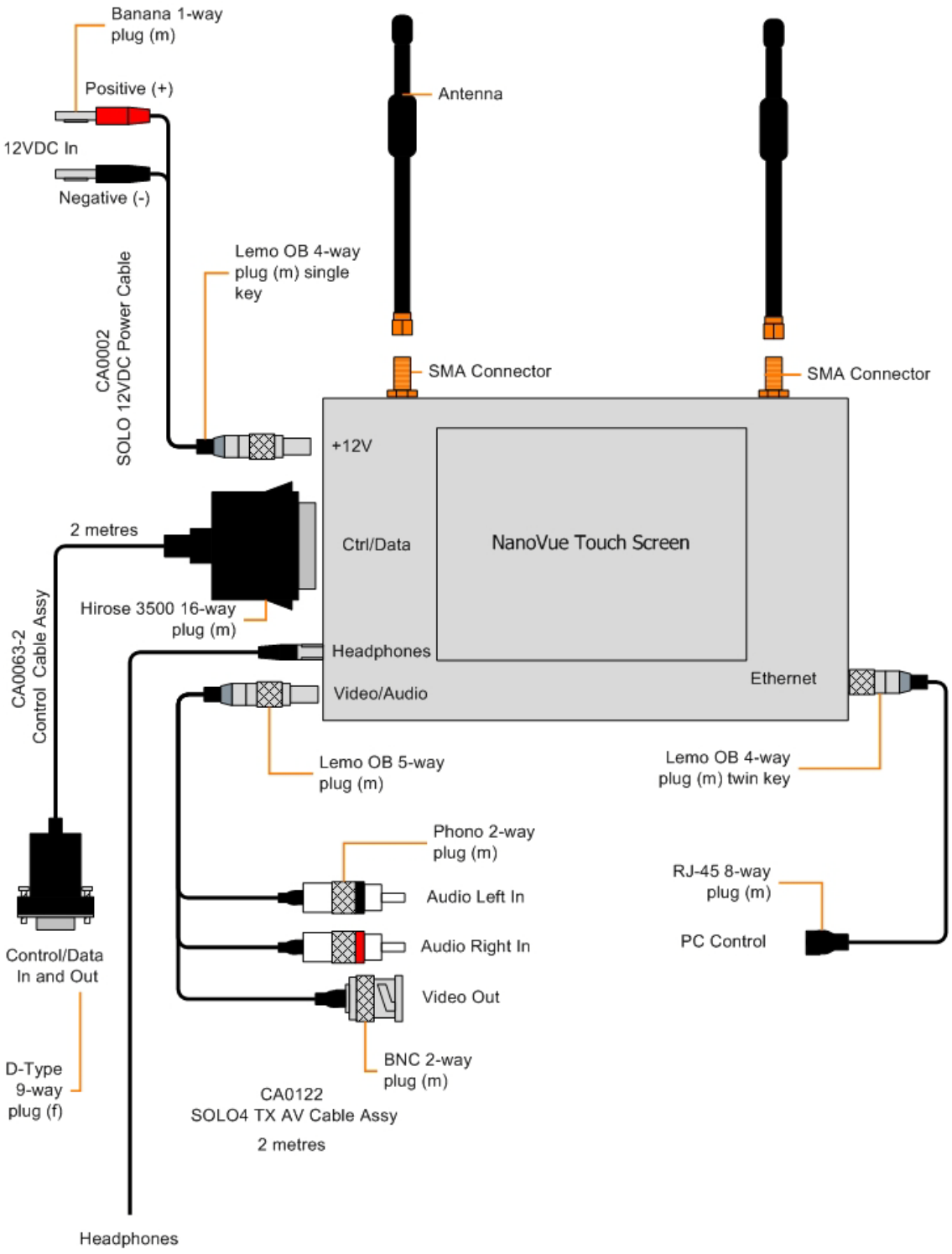


Figure 01-60-01 – Main System Diagram

01-70 Hardware System

The Receiver device comes in **one** case type:

- NanoVue Body Worn Receiver

01-70-01 NanoVue Body Worn Receiver Type

The receiver has two SMA connections for the antennas, a Hirose for Data/Control and three Lemo connections for Power, Ethernet and AV.

Its Product Code is SOL4NNV-217250.

Figure 01-70-01 – NanoVue Receiver

01-80 Software System

Each NanoVue Receiver has **two** software elements:

- Software that runs within the device on the FPGA chip.
- A **Control Application** that you run on a Windows PC outside the device using a web browser.

01-80-01 Internal Software

Although much of the radio is built up of hardware components, many of the sophisticated features are implemented in software running on a Field Programmable Gate Array (FPGA).

When a new software release is available for the NanoVue, Cobham will supply customers with a software upgrade.

Cobham will generate a new upgrade file (with the file extension .upg) which we'll send to you.

01-80-02 Control Pages

The software tools provide users a convenient access to the most common features and functions of the Device. All software tools are implemented as a web interface. The advantage of a web interface is that it is independent from the user's operating system and doesn't require any specific software on the host PC.

The Touch Screen on the front of the unit gives access to many of the features of the radio but for more sophisticated operations and configuration tasks you'll connect up a PC running a web browser to access the Control Pages on your NanoVue.

The Control Pages enables you to set up sixteen presets in the radio and have control over many parameters of the unit.

Here's what the receiver's Control Pages look like:

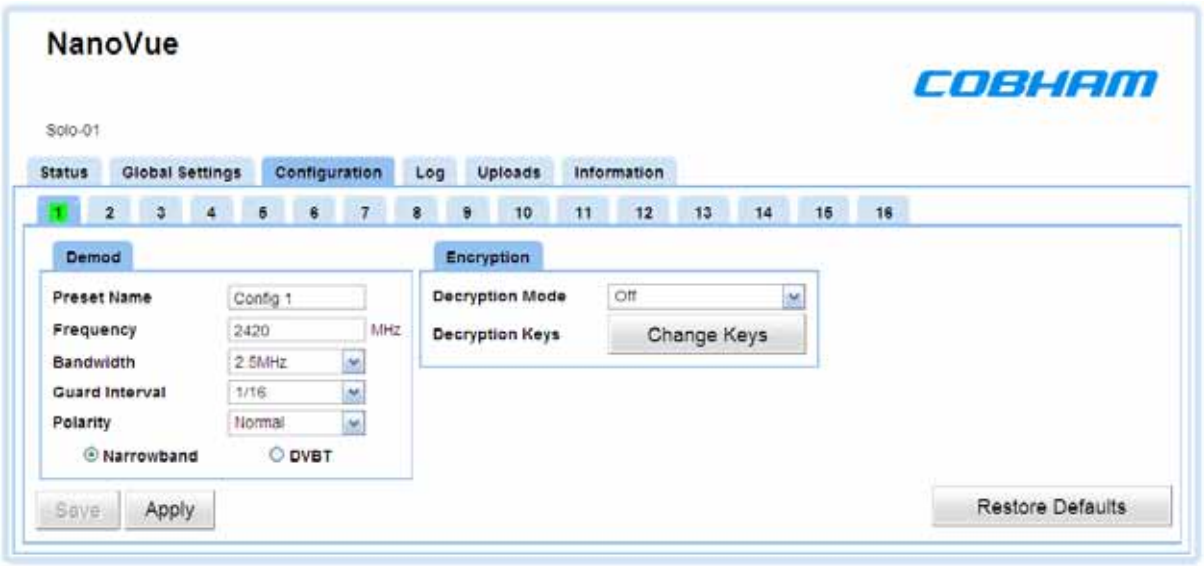


Figure 01-80-02 – The Receiver's Control Pages looking at the Configuration tab

02-Equipment Schedule

02-00 General

To use the kit effectively it is important to be able to identify each of the elements of the system and understand how they fit together.

02-10 Equipment Schedule System

This section describes the NanoVue Equipment Schedule. Naturally you'll also need a transmitter to form a complete SOLO4 link.

02-10-01 NanoVue Equipment Schedule

Item	Part No	No	Description
1	SOL4NVV-217250	1	NanoVue receiver with a frequency range of 2.17 GHz to 2.50 GHz.
2	CA0002	1	Power Cable Assembly (3 metres) Lemo OB 4-way plug (male) to Banana 1-way plug (male) red and Banana 1-way plug (male) black
3	CA0063	1	Control/Data Cable Assembly Hirose 3500 16-way plug (male) to D-Type 9-way plug (female)
4	CA0122	1	Audio Video Cable Assembly (2 metres) Lemo OB 5-way plug (male) to Phono 2-way plug (male) red, Phono 2-way plug (male) black, BNC 2-way plug (male)
5	CA0505	1	Lemo Ethernet Cable Lemo OB 4-way plug (male) to RJ45 8-way plug (male)
6	AP001622	2	2dBi flexi SMA mount antennas
7		1	CD with manual

02-10-02 NanoVue Equipment Options

Item	Part No	No	Description

03-Placards and Markings

03-00 General

You'll need to be able to quickly identify equipment types and serial numbers you have and at what frequencies your systems are designed to work. You may need to find the Serial Number during a support call for example.

The simplest way is to check the placards and markings on the units and this section shows you how to decode them.

03-10 Exterior Placards and Marking System

The outside of each NanoVue receiver unit is marked with several placards:

- Product Code, CE and Serial Number Placard
- Warranty Void Placard

03-10-01 Product Code, CE and Serial Number Placard

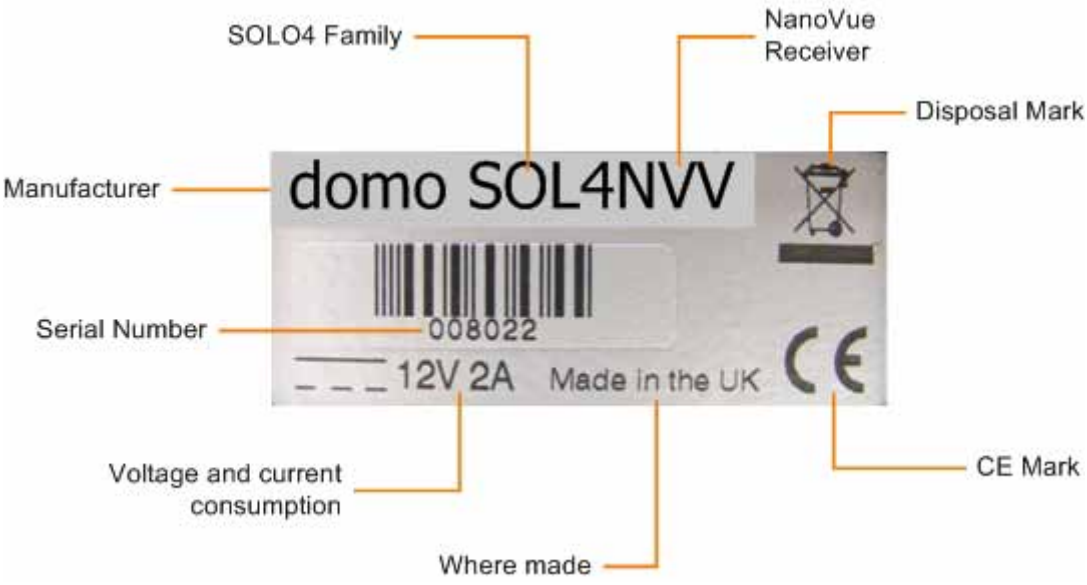


Figure 03-10-01 - Product Code Placard

The **CE marking** (also known as **CE mark**) is a mandatory conformity mark on many products placed on the single market in the European Economic Area (EEA).

The **CE marking** certifies that a product has met EU consumer safety, health or environmental requirements.

03-10-02 Warranty Void Placard

Figure 3-10-02 - Warranty Void Placard

03-20 Interior Placards and Marking System

There are no interior placards and markings that will concern the operator of this unit.

03-30 Exterior Colour Schemes and Marking System

03-30-01 Enclosure Colour

The main enclosure is finished in a matt black paint finish.

03-30-02 Panel Markings

The markings on the interface panels are white.

04-Cautions and Warnings

04-00 General

There are some general cautions and warnings which should be observed when using this equipment.

04-10 Enclosure System

Do not remove any factory installed screws or fastenings. Damage to the units may result and void any warranties.

Only authorized, trained personnel should open the product. There are no functions that required the user to gain access to the interior of the product. There are no user serviceable parts inside.

04-20 Maintenance System

No scheduled maintenance is required to ensure proper function of the unit.

04-30 Environment System

Operate within the environmental limits specified for the product.

Do not subject the indoor equipment to splashing or dripping liquids.

04-40 Electrical System

Care should be taken with the electrical supply for this device.

04-40-01 Power Supply

Ensure that the power supply arrangements are adequate to meet the stated requirements of each product. Observe all electrical safety precautions.

04-40-02 Electro Static Discharge (ESD) Precautions

ESD guidelines must be followed for this electrostatic sensitive device.

04-40-03 Lightning Protection

Antennas should be adequately protected from lightning strikes.

04-50 Working at Height

Observe caution when locating the device at height, for example on a mast. Ensure the unit is well secured to prevent it falling and injuring personnel.

04-70 Thermal Control System

Any powered device will always produce heat as a by product of its operation. If you operate this device in an enclosed space you must ensure it has adequate airflow to keep it cool.

Also, if worn close to the body, care must be taken to protect the operator from excessive temperatures.

CAUTION: If this equipment is operated in a high temperature environment like a car in summer the case can become very hot. You must protect your body.

04-80 EMC / Safety and Radio Approvals

The equipment has been designed to meet and has been tested against the following harmonized EMC and safety standards:

The unit remains complaint to CLASS A “EMC tests performed to EN 301 489-1: 2002 as modified by EN 301 489-5, EN61000-3-2:2001 and EN61000-3-3:2000- (no additional filter or gasket).

04-90 CE Marking

The CE mark is affixed to all SOLO4 and SOLO2 products, and the CE Declaration of Conformity, as well as the technical file are available on request.

05-Panels, Displays, Controls, Indicators and Alarms

05-00 General

You'll need to be able to find all the interface connections and controls on the unit. You'll also need to be able to identify and interpret any alarms or indicators. This section will help you identify all these features.

Each NanoVue has **front, top, left** and **rear** panels which contain all the interface connections for the units and the controls and indicators. There is an operational control panel on the front of the unit in the form of a touch screen.

05-10 Panel System

The NanoVue receiver has **four** panels located on:

- Front 05-10-01
- Top 05-10-03
- Left 05-10-05
- Right 05-10-06

05-10-01 Front Panel

Figure 05-10-01-001 - NanoVue Receiver Front Panel showing Image

Figure 05-10-01-002 - NanoVue Receiver Front Panel showing Touch Screen Controls

05-10-03 Top Panel

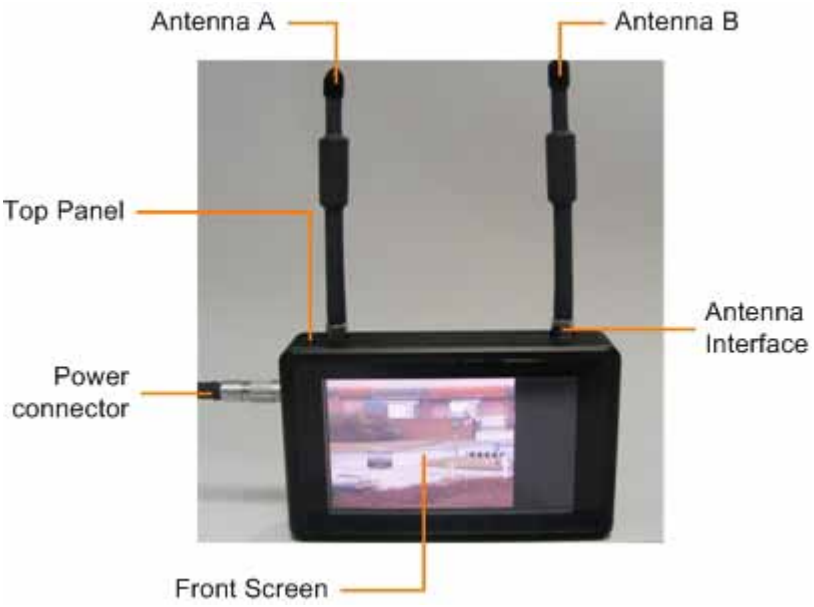


Figure 05-10-03 - NanoVue Receiver Top Panel

05-10-05 Left Panel

Figure 05-10-05 - NanoVue Receiver Left Panel

05-10-06 Right Panel

Figure 05-10-06 - NanoVue Receiver Right Panel

05-20 Indicator System

There are no indicators on the unit. All visual cues are delivered through the touch screen.

05-30 Control Panel System

The control panel is presented as a **touch screen** and is located on the front panel.

05-30-01 Status Touch Screen Button

Status	When you are viewing the video display, the **Status** touch screen button switches to the **Status display** on the touch screen.

Figure 05-30-01 - NanoVue in Video Mode

05-30-02 X Touch Screen Button

X	Press the **X** touch screen button to switch back to video display.

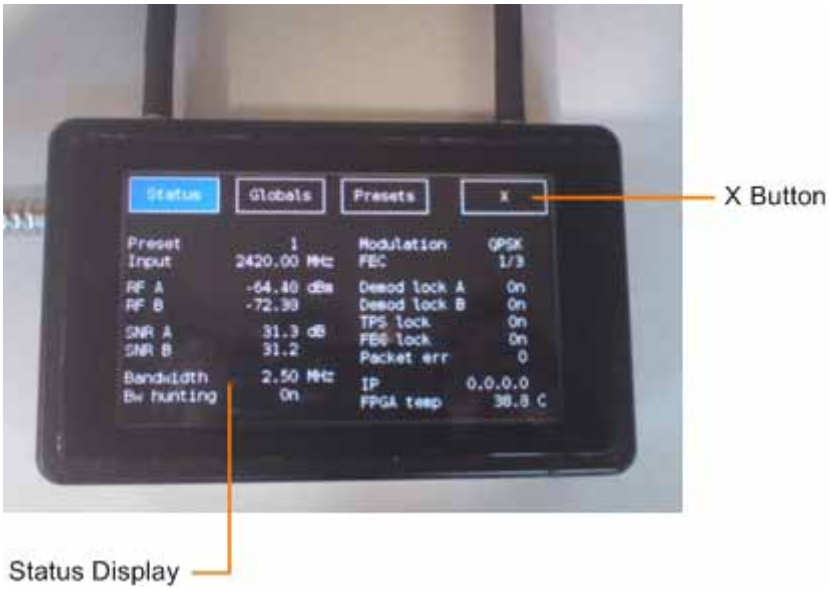


Figure 05-30-02 - NanoVue in Status Screen

05-40 Alarm System

There are no alarms on the unit.

05-50 Display System

The NanoVue Receiver is equipped with a diagnostic **Touch Screen** display. This system consists of **three** pages of information to help you with test and setup.

05-50-01 Touch Screen Display

The touch screen display function is selected using the **Status Button** when viewing the video display. You'll then see the display shown below.

From the toolbar you can now select:

- **Status**
- **Globals**
- **Presets**

To return to **video** display, press the X button.

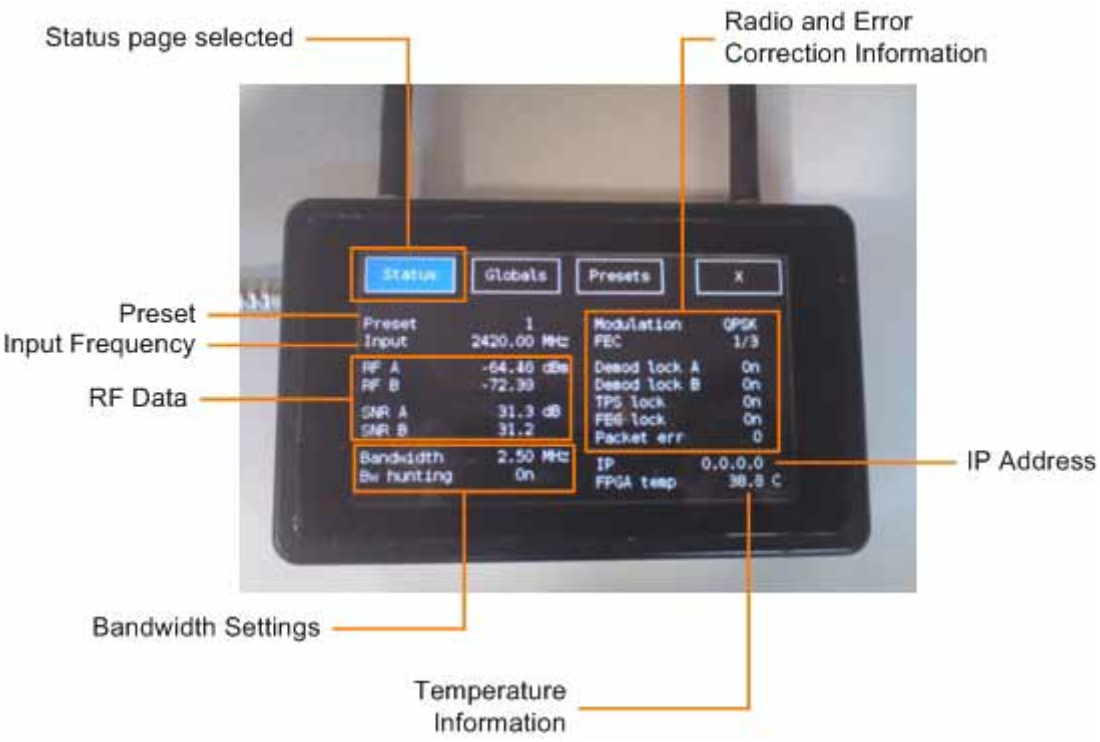
Figure 05-50-01 - NanoVue in Status Screen

05-51 Status Page System

The **Status Page** enables you to see **diagnostic data** about the **signal** you are receiving.

05-51-01 Selecting the Status Page

The **status page** is selected using the **Status Button** when viewing the video display. You'll then see the display shown below.



05-51-02 Status Button

The **Status Button** selects the status page. It is backlit in blue when the page is selected.

05-51-03 Preset

The **Preset** field displays the number of the preset in use. It can be any number between 1 and 16.

05-51-04 Input

This **Input** field displays the **frequency** being received on the unit in **MHz**.

05-51-05 RF Data

Unit Parameter	Options	Notes
RF A	0 to -130	The level in dBm of the signal being received on antenna A. There are readings for both antennas.
SNR A	0 to 25	The signal to noise ratio of the signal being received on antenna A. There are readings for both antennas.

05-51-06 Bandwidth Settings

Unit Parameter	Options	Notes
Bandwidth	DVBT:6, 7 & 8 MHz Narrowband: 2.5 MHz 1.25 MHz 625 kHz	DVB-T bandwidths (normally used for broadcast). Cobham narrowband (normally surveillance use). Cobham Ultra-narrowband (this is a licensable feature, normally surveillance use).
BW Hunting	Off or On	When enabled, and when unit is operating in Narrowband mode, NanoVue will change its bandwidth automatically to match that of the transmitter.

05-51-07 Radio and Error Correction Information

Unit Parameter	Options	Notes
Modulation	QPSK, 16QAM, 64QAM	This field indicates the OFDM constellation being received. QPSK-less user data, more robust, more range. 16QAM-more user data, less robust, less range. The mode is automatically

		detected and is simply displayed here. You can't change it other than at the transmitter.
FEC	1/3 or 2/3	This field indicates the forward error correction (FEC) rate which is being applied. 1/3-less user data, more FEC data, more robust, more range. 2/3-more user data, less FEC data, less robust, less range. The mode is automatically detected and is simply displayed here. You can't change it other than at the transmitter.
Demod Lock A	Locked or Not Locked	Tells you if the unit has successfully demodulated the incoming RF from antenna A.
Demod Lock B	Locked or Not Locked	Tells you if the unit has successfully demodulated the incoming RF from antenna B.
TPS Lock	Locked or Not Locked	Transmission Parameter Signalling lock.
FEC Lock	Locked or Not Locked	Forward Error Correction lock.
Packet Err	0 is ideal. Could be any number.	The number of packet errors coming out of the error correction system. Any error here will corrupt the video, audio or data signals coming through the receiver.

05-51-08 IP

This field reports the IP (Internet Protocol) address of the unit. You can use this address to communicate directly with the units using a PC with a web browser. The IP address will be in the form 192.168.2.120.

When DHCP is enabled and the unit is powered on without being connected to an Ethernet network, this will be 0.0.0.0.

05-51-09 FPGA Temp

Unit Parameter	Options	Notes
FPGA temp	60.0 or any number	The internal temperature of the FPGA in degrees Celsius. This should be in the region of 50-80 degrees Celsius.

05-52 Globals Page System

On the Globals page, you can change the Ethernet parameters of the unit and also toggle between Day and Night modes.

05-52-01 Selecting the Globals Page

The **globals page** is selected using the **globals button** when viewing the status display. You'll then see the display shown below.

05-52-02 IP Address

This field controls the static IP address of the unit. You can edit the IP Address when DHCP is disabled. To edit the value, simply touch the field and the on screen keyboard will open. Enter a new value on the keyboard page and then press the OK button.

05-52-03 Network Mask

Subnet masks accompany an IP address and the two values work together. Applying the subnet mask to an IP address splits the address into two parts, an "extended network address" and a host address. You can edit the Subnet Mask when DHCP is disabled.

To edit the value, simply touch the field and the on screen keyboard will open. Enter a new value on the keyboard page and then press the OK button.

05-52-04 IP Gateway

A **gateway** is a node (a router) on a TCP/IP Network that serves as an access point to another network.
A **default gateway** is the node on the computer network that is chosen when the IP address does not match any other routes in the routing table.

You can edit the IP Gateway when DHCP is disabled.

To edit the value, simply touch the field and the on screen keyboard will open. Enter a new value on the keyboard page and then press the OK button.

05-52-05 Use DHCP

This radio button allows you to enable or disable DHCP (Dynamic Host Configuration Protocol).

When enabled, the unit will be allocated an available IP address on the local Ethernet network. When disabled, the user has to assign the above three IP parameters.

To edit the value, simply touch the field. It is enabled when the blue square is shown inside the box.

05-52-06 Night Mode

This radio button enables you to enable or disable Night Mode.

To edit the value, simply touch the field. When enabled, the unit will dim its video screen for use in a dark environment.

05-52-07 Editing the IP Parameters

Turning DHCP off immediately enables you to edit the IP parameters. You enter the keypad editor by touching the required parameter, e.g. the IP address.

The **DEL** button deletes one character at a time

The **CLR** button deletes the entire address. After entering the new address, press **OK** to accept. 'X' will return to the previous screen without saving any changes.

05-52-08 Apply Button

On the Globals page, press **APPLY** for these changes to become active. If you don't press **APPLY**, the changes are lost.

Similarly, to activate the Night Mode setting, **Apply** has to be touched.

05-53 Presets Page System

On the **presets** page, you can change the presets of the unit and also configure live and non-live presets.

05-53-01 Selecting the Presets Page

The **presets page** is selected using the **presets button** when viewing the status display. You'll then see the display shown below.

05-53-02 Preset

This field controls the preset currently being edited on the unit. The currently loaded preset is indicated by a blue background, while a non-live preset is indicated by a black background.

05-53-03 Input (MHz)

The Input field returns the input frequency of the currently selected preset in MHz.

05-53-04 Narrowband

This radio button toggles between narrowband and DVB-T modes.

Note: This switch only works if the unit is licensed for DVB-T mode.

05-53-05 Guard Int

This drop-down list enables you to select different Guard Intervals. When you are in DVB-T mode, the drop-down will display DVB-T guard intervals.

05-53-06 Bandw (MHz)

This drop-down list enables you to select different Bandwidths. When you are in DVB-T mode, the drop-down will display DVB-T bandwidths.

05-53-07 Changing the Preset

To change the preset, touch the preset button which opens the following page:

Select the preset to be loaded. Press **OK** to load this preset or X to exit without saving.

After editing the required preset parameters, hit **Save** to save the changes without making the preset live, or hit **Apply** to save the changes and make them live.

Note: Navigating to a different screen without touching either **Save** or **Apply** means change will be lost.

06-Interfaces

06-00 General

The NanoVue receiver provides several interfaces to enables you to connect power and payloads to the unit. You'll need to understand what these interfaces are and how to use them.

06-10 Power Interface System

Electrical power is supplied to the NanoVue receiver using the Lemo OB 4-way jack (female).

06-10-01 Power Interface – Lemo OB 4-Way Jack

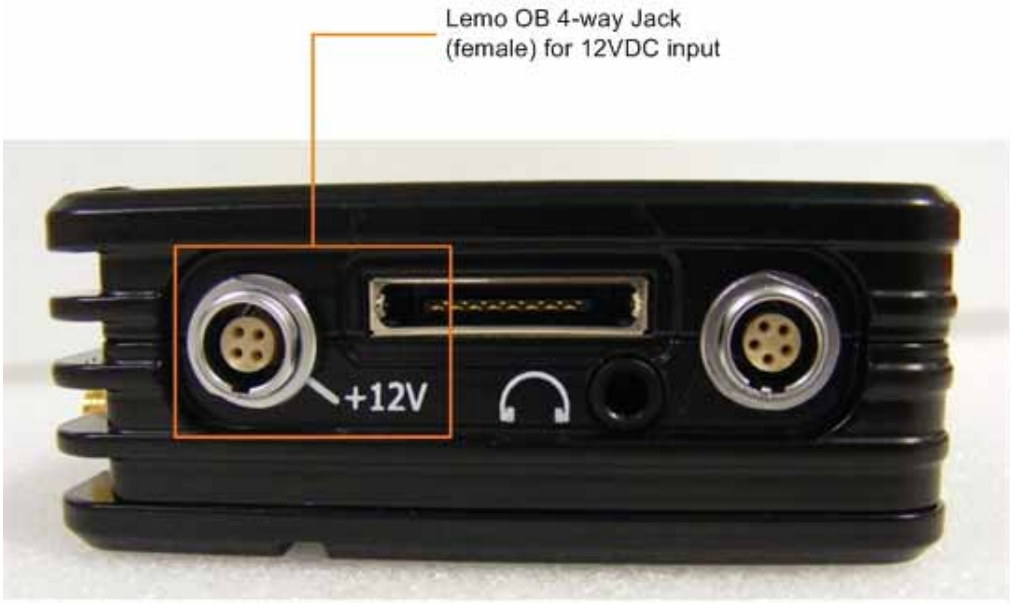


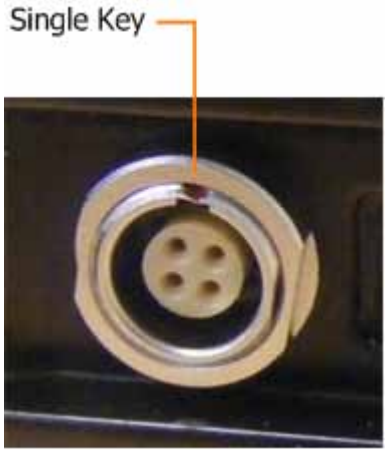
Figure 06-10-01-001 – NanoVue Receiver Power Interface

The unit accepts **12VDC** through the **power interface** on the left side of the left panel. This is a Lemo OB 4-way jack, female marked **+12V**.

Your **CA0002 battery cable assembly** or the **AC adapter cable** fits in here.

Align the **red spot** on the Lemo plug with the red spot on the Lemo jack and gently push the plug into the jack. Use minimal force!

The Lemo plug will **click** as it **locks** into the jack. **To release**, grip the knurled barrel of the Lemo plug and **gently** pull away from the unit. The barrel will slide back and release the locking system.



Single Key

If you look at the **red spot** on the jack you'll see that there is a single small cut out.

This is called a **Single key** and ensures that only plugs with the same single key can be inserted into this jack.

The power plug and jack on NanoVue receivers have a single key.

Figure 06-10-01-002 – Lemo OB Single Key Arrangement

06-20 Video Interface System

The NanoVue is provided with a composite video and line level audio output connector for situations where the user requires an additional external display monitor.

Typically the video display device will be a high quality monitor and the audio output device will be monitoring speakers.

Video is output from the receiver using a Lemo OB 5-way jack.

06-20-01 Video Interface – Lemo OB 5-Way Jack

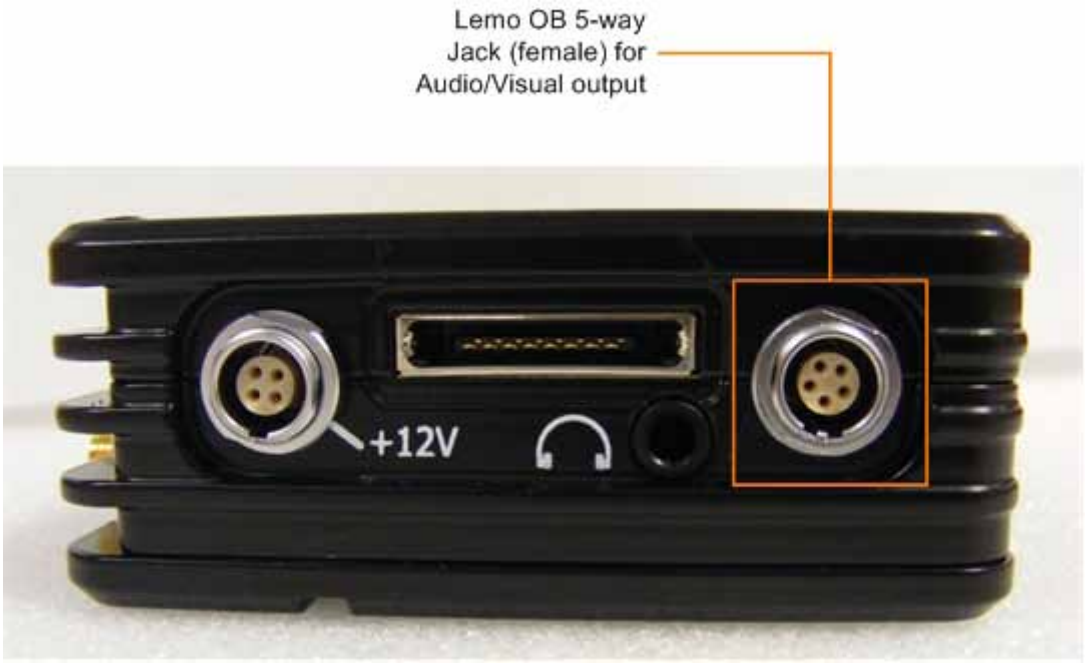


Figure 06-20-01 – NanoVue Receiver Video Interface

The unit outputs **video** signals through the **video interface** on the right side of the left panel. This is a Lemo OB 5-way jack, female. It is not marked.

Your **CA0122 Audio Video cable assembly** fits in here.

06-30 Audio Interface System

The NanoVue is provided with a composite video and line level audio output connector for situations where the user requires an additional external display monitor.

Typically the video display device will be a high quality monitor and the audio output device will be monitoring speakers.

Audio is output from the receiver using a single Lemo OB 5-way jack.

06-30-01 Audio Interface – Lemo OB 5-Way Jack

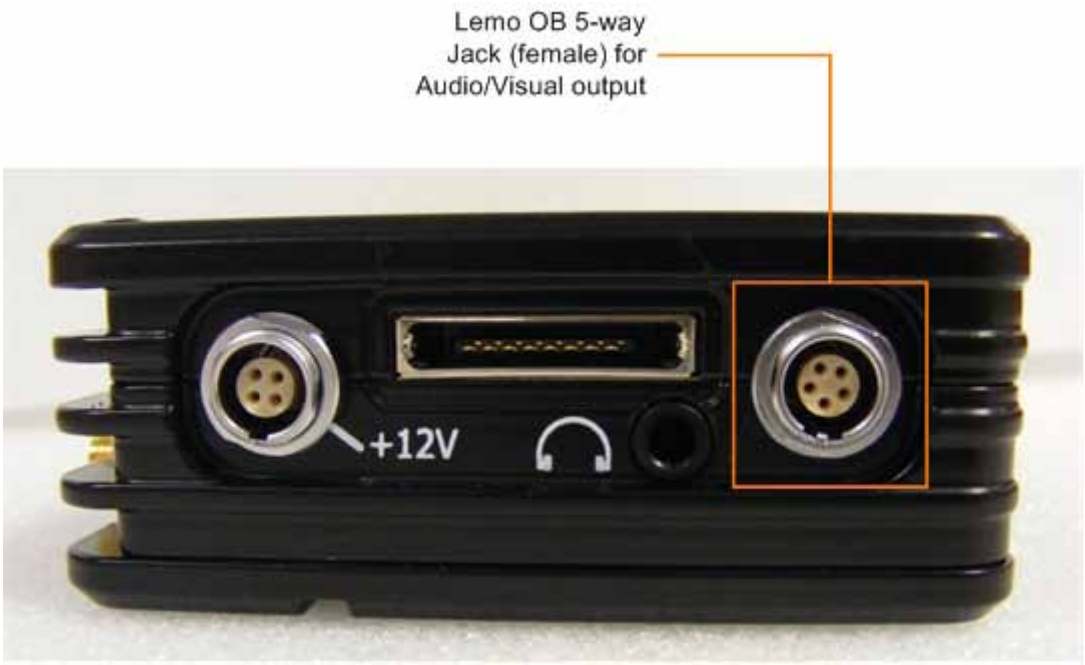


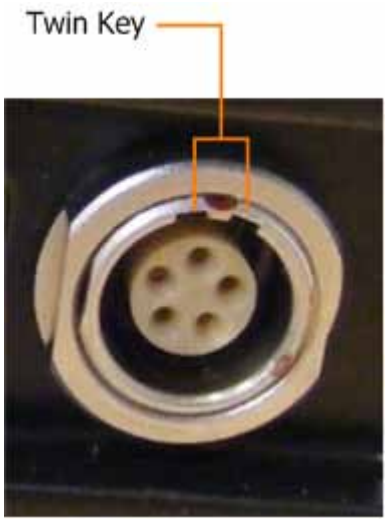
Figure 06-30-01-001 – SOLO4 Receiver Audio Interface

The unit outputs **Audio** through the **audio interface** located on the right side of the left panel. This is a Lemo OB 5-way jack, female. It is not marked.

Your **CA0122 Audio Video cable assembly** fits in here.

Align the **red spot** on the Lemo plug with the red spot on the Lemo jack and gently push the plug into the jack. Use minimal force!

The Lemo plug will **click** as it **locks** into the jack. **To release**, grip the knurled barrel of the Lemo plug and **gently** pull away from the unit. The barrel will slide back and release the locking system.



Twin Key

If you look at the **red spot** on the jack you'll see that there are two small cut outs.

This is called a **Twin key** and ensures that only plugs with the same twin key can be inserted into this jack.

The Audio plug and jack on NanoVue receivers have a twin key.

Figure 06-30-01-002 – Lemo OB Twin Key Arrangement

06-30-02 Audio Interface – 3.5mm TRS 3-Way Headphone Jack

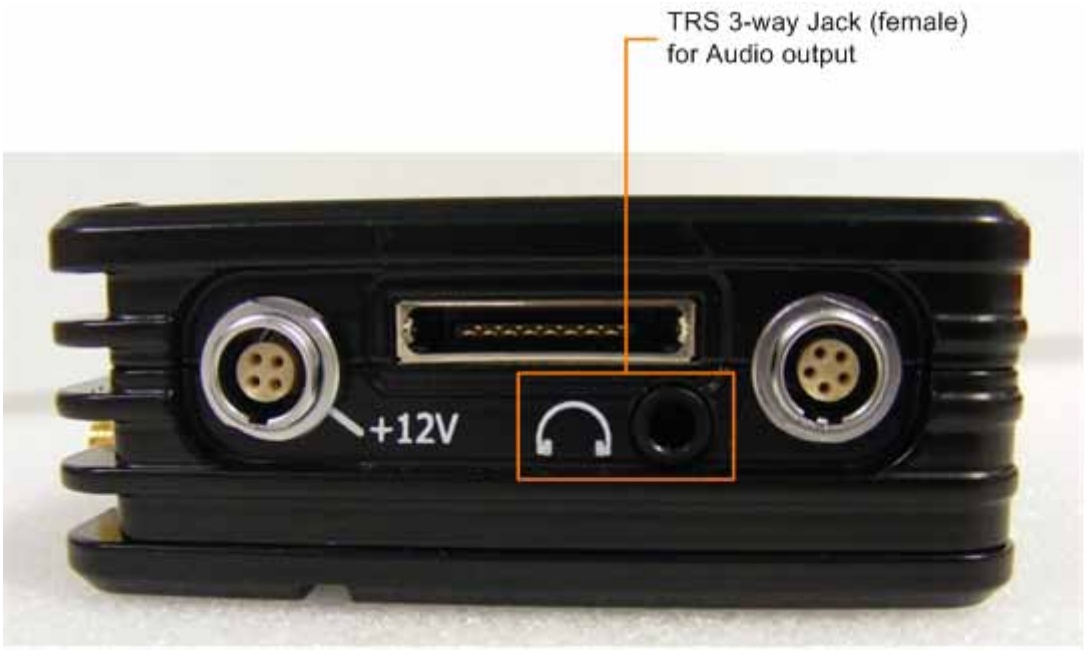


Figure 06-30-02 – NanoVue Receiver Headphone Audio Interface

The unit outputs **Audio** through the **Headphone audio interface** in the centre of the left panel. This is a TRS 3.5mm 3-way jack, female and is marked with a headphone symbol.

06-40 Data Interface System

Data is output from the receiver using a single Hirose 3500 16-way jack.

06-40-01 Data Interface – Hirose 3500 16-Way Jack

Figure 06-40-01-001 – NanoVue Receiver Data Interface

The unit outputs **data** signals through the **data/control interface** in the centre of the left panel. This is a Hirose 3500 16-way jack, female. It is not marked.

Your **CA0070 data cable assembly** fits in here.

Figure 06-40-01-002 – Hirose 3500 plug and Data Interface

The Hirose plug we supply normally has the letters **HRS** on its **top** surface. With the receiver sitting upright, you should see the HRS label uppermost as you insert the Hirose. It should **only** be inserted this way up.

The Hirose plug will **click** as it **locks** into the jack. To release, press **both** the release catches on the sides of the Hirose and gently pull the plug away from the unit.

06-60 IP Interface System

The IP interface enables you to control the unit using a PC with a web browser and for streaming video. The twin key 4-pin Lemo connector on the side of the unit marked **Ethernet** is compatible with 10/100 Base-T Ethernet networks.

06-60-01 IP Interface

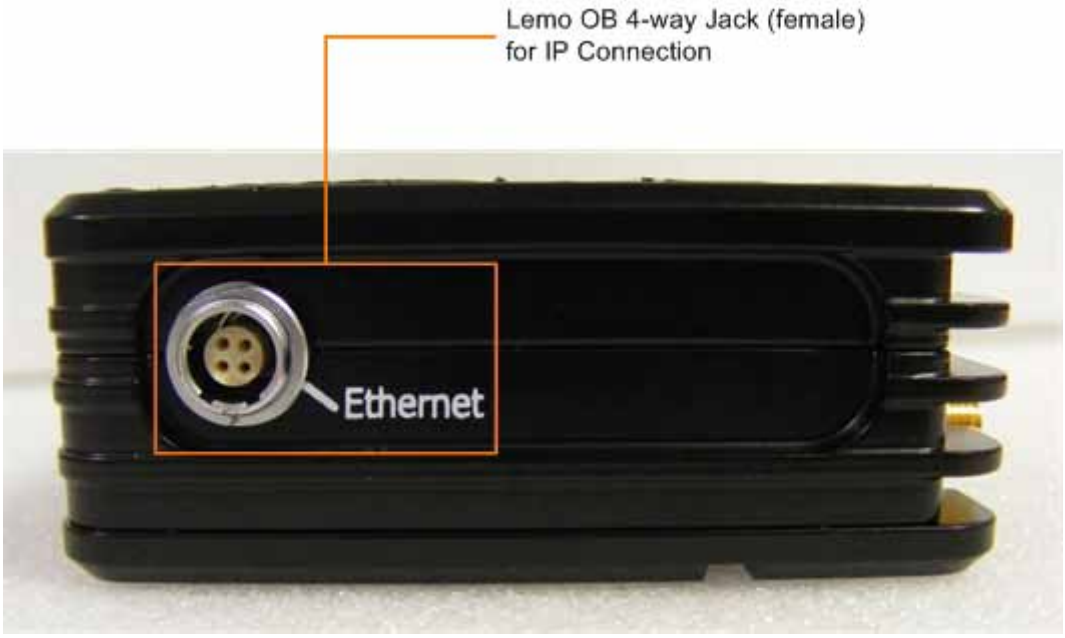


Figure 06-60-01 – NanoVue Receiver IP Interface

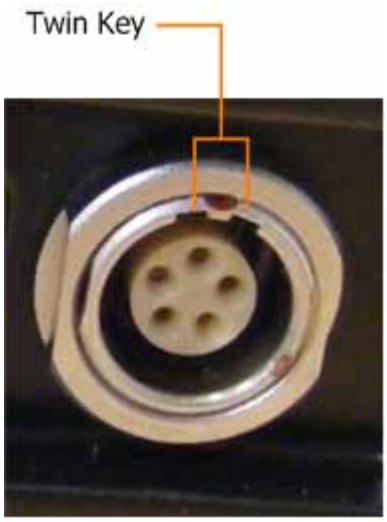
The unit passes IP signals through the **IP interface** on the left of the right panel. This is a Hirose 3500 16-way jack, female marked ETHERNET.

Your **Lemo OB Ethernet cable assembly** fits in here.

This is the cable you use to connect your Windows Personal Computer to the unit to run the Control Pages. The Control Pages enables you to set up the unit using a web browser.

Align the **red spot** on the Lemo plug with the red spot on the Lemo jack and gently push the plug into the jack. Use minimal force!

The Lemo plug will **click** as it **locks** into the jack. **To release**, grip the knurled barrel of the Lemo plug and **gently** pull away from the unit. The barrel will slide back and release the locking system.



Twin Key

If you look at the **red spot** on the jack you'll see that there are two small cut outs.

This is called a **Twin key** and ensures that only plugs with the same twin key can be inserted into this jack.

The Ethernet plug and jack on NanoVue receivers have a twin key.

06-70 Antenna Interface System

There are two antenna interfaces located on the top panel of the NanoVue receiver.

06-70-01 Antenna Interfaces – SMA 2-Way Jacks

You attach the antennas to the **antenna interfaces** on the top panel. These are SMA 2-way jacks, female. They are not marked.

Figure 06-70-01 – SMA Antenna Interface

07-Planning

07-00 General

Radio operations always benefit from careful planning. This can help you avoid loss of signal due to frequency clashes or other forms of interference. Issues like the provision of power to the units can be carefully planned prior to the operation of the set.

07-10 Frequency Planning

There are not enough radio frequencies available for all radio operators to have their own channel. You may discover that your planned radio frequency is being used by other people.

Microwave frequencies often have to be reused within the same operation by more than one unit. The frequency management authority will try to make certain that users of the same frequency are as far away as possible from each other, but some units (out of area units in particular) could join at some stage in the operation.

There is one final source of frequency interference: the use of unauthorised frequencies. This practice is illegal and has the potential to disrupt a carefully engineered frequency plan, introduce interference to other frequencies and circuits, and prevent other units from fulfilling their mission. Radio operators should never use unauthorized frequencies.

07-20 Interference Planning

Radio frequency interference is always present in the environment. It may come from a single source or a combination of many sources including natural or manmade frequency interference, poor equipment condition, improper equipment usage, frequency interference, use of unauthorized frequencies, and frequency reuse.

07-20-01 Natural Interference

Natural radio noise has two principal sources: thunderstorms (atmospheric noise) and stars (galactic noise). It is especially noticeable at night when the lower frequencies propagate farther than in the daytime.

The only way to reduce this type of interference is to use a directional antenna to prevent receiving the interference from all directions. However, this will not eliminate the noise coming from the direction of the received signal. Use of a higher frequency will also help, although if a sky wave circuit is used, care must be exercised not to pick the highest frequency at which the signal will be refracted to Earth by the ionosphere (i.e., the critical frequency).

07-20-02 Manmade Interference

Most manmade interference comes from electrical sources such as power generators, alarm systems, power lines, auto ignition, fluorescent lighting, faulty electrical relay contacts, and electrified railroads. Manmade interference also includes enemy jammers (see chapter 7). The key to combating this form of interference is to isolate communications equipment from

manmade interference. The interference from known sources such as generators can be greatly reduced if an antenna is positioned so that an obstacle (e.g., a hill) is between it and the source. This must be done so that the same obstacle will not block the intended radio path. If the interference is not coming from the same direction as the intended signal, then a directional antenna should be used.

07-30 Battery Planning

One of the biggest challenges with mobile devices has always been battery life. Many factors affect power consumption in an individual device.

Even if never taken out of the original package, disposable batteries can lose 8 to 20 percent of their original charge every year at a temperature of about 20-30 degrees Celsius.

This is known as the **self discharge** rate and is due to non-current-producing **side** chemical reactions, which occur within the cell even if no load is applied to it.

High or low temperatures may reduce battery performance. Temperature has severe affects on battery performance and these affects depend greatly on the battery chemistry used. A rule of thumb for temperature degradation is that battery performance will decrease by 35% at either the upper or lower range of the specified operating threshold, outside the threshold the battery may not work at all.

Consider how long you expect the operation will go on and plan your battery capacity around this.

07-40 Storage Planning

Equipment should be stored in tough, rugged and weatherproof cases with a suitable packing material such as cubed multilayer foam.

08-Antennas

08-00 General

Of all the variables affecting single-channel radio communications, the one factor that an operator has the most control over is the antenna. With the right antenna, an operator can change a marginal net into a reliable net.

08-10 Antenna System

Each NanoVue Receiver unit requires **two** antennas. Both antennas **must** be fitted to achieve best performance.

08-10-01 Assembling the Antenna System

NanoVue Receiver units normally use simple Omni-antennas and do not require any rigging. Naturally, it is possible to use a variety of antenna types for specialist applications. Discuss this with your Cobham contact.

08-10-02 Attaching the Antennas

You'll need a NanoVue receiver and two antennas. The **ANT2-200250**, 2dBi wide band rugged SMA mount antenna 2.00 - 2.50GHz would be a typical example for an S-Band receiver.

1. Connect the antennas to the SMA connectors on the top panel of the NanoVue units.
2. Do not over tighten the antenna – hand tight only!

CAUTION: Antennas should be connected **directly** to the NanoVue unit. If you have to use cables between the antennas and the NanoVue (in a mobile application for example), keep them short and use very high quality cable.

Note: There are many types of antenna that can be fitted to the NanoVue Receiver unit. Your antennas may look different from those in this guide. For more advice on antenna types call your Cobham representative.

08-20 Downconverter System

All our receiver units use **downconverters** to lower the frequency from microwave (L, S and C-Band) to an Intermediate Frequency (IF) between 51 and 858MHz that the onboard tuners in the receivers can use.

The NanoVue has the downconverters built into the unit. This means you must choose the band you want to operate in when you order your NanoVue and you will be given the correct variant.

08-30 Upconverter System

There are no up converters in receivers.

08-40 Cable System

Always try to connect the antenna directly to the NanoVue. If you must locate the antenna away from the NanoVue (say, in an aircraft or vehicle) then keep the cable run short. Always use the best possible RF cable to avoid losses.

08-50 Antenna Polarization System

COFDM links are very robust and are tolerant to changes in antenna position, however, it is advantageous to try and keep the antennas in the same plane if possible.

08-50-01 Linear Polarization

The antennas used with the NanoVue links are normally linearly polarized.

09-Electrical Power

09-00 General

The NanoVue receiver requires 12VDC. This can be supplied from a vehicle, an AC Adaptor or the specially designed NanoVue clip-on battery pack which attaches to the back of the unit.

When power is applied to the NanoVue the screen will remain blank for about seven seconds while the unit boots up. This will be followed by a blue screen which will then show video if the corresponding transmitter is switched on.

Video is displayed to the left side of the screen in 4:3 aspect ratio.

The current preset, frequency and the unit's SNR values are displayed in the column to the right of the video.

09-10 AC Power Supply System

The unit can be powered from AC by using a suitable AC Adapter. If AC power is available at the location where you want to operate the unit then clearly this is the best option.

09-10-01 Connecting to AC Supply

You'll need a **NanoVue Receiver** and an **AC Adaptor**.

1. Connect the **Lemo OB 4-way plug** (male) from the AC adaptor to the **Lemo OB 4-way jack** (female) on the NanoVue Receiver which is located on the left side of the front panel.

2. Now connect the **IEC mains 3-way plug** (female) to the **IEC mains 3-way jack** on the AC adaptor.

3. Connect IEC mains plug to your **local AC supply** and switch on.

09-20 DC Power Supply System

The unit can be powered from DC by using suitable batteries or a vehicle power source. Take care that the vehicle supply is within limits for this unit. Aircraft for example, normally use 28VDC supplies.

Also, be careful to get the polarity correct when connecting to a DC power source.

09-20-01 Connecting to DC Supply

You'll need a **NanoVue Receiver** and the **CA0002 Power Cable Assembly**.

1. Connect the **Lemo OB 4-way plug** (male) from CA0002 cable to the **Lemo OB 4-way 12V jack** (female) on the NanoVue Receiver.
2. Connect the **banana plugs** to a suitable 12VDC supply.

CAUTION: When using a 12VDC supply ensure the **polarity** is correct. The **red** banana plug should be connected to the **positive** terminal. The **Black** banana plug should be connected to **negative** terminal.

Cobham Battery Pack (SOLBAT2)

If you have a Cobham battery pack, connect the Lemo OB 4-way plug (male) from the battery pack to the Lemo OB 4-way 12V jack (female) on the NanoVue which is on the left side of the left panel.

Figure 09-20-01 – Cobham Battery Pack

09-21 Battery Pack System

For increased portability, the unit can be powered by the custom NanoVue clip-on rechargeable battery pack, which provides between 4 and 5 hours continuous battery life.

09-30 Power Consumption

Here are the figures for power loading on the NanoVue Receiver.

DC Input 6 to 16V Reverse Polarity Protected.

Power Consumption is typically 9W depending on mode.

As an example, current at 12V and 9W is 0.75A.

09-30-01 Battery Calculations

You'll need to know how long the unit will operate with batteries. Here's how you work it out.

An approximate measurement of a battery's ability to provide energy is its rating in amp hours (Ah). A 100Ah battery will produce 100 amps for 1 hour.

A 100Ah battery could produce 1 amp for 100 hours or 50 amps for 2 hours, 4 amps for 25 hours or 25 amps for 4 hours etc.

The formula you need is:

Time (H) = Battery capacity (Ah) / Current drawn (I)

Where:

H is the **time** the battery will last.

Ah is the **amp hours** of the battery you're planning to use

I is the **current** drawn by the unit you want to power

Let's take a **NanoVue Receiver** as an example. If we look at the **Power** section of the **Data Sheet**, we see these numbers:

Power	
DC Input	6 to 16V Reverse Polarity Protected
Power Consumption	9W depending on mode

So, we have a range of voltages, no current shown, but they do tell us typical power consumptions in Watts!

First thing to do is choose a **voltage**. This is normally is **12VDC** when we are working off the batteries we normally supply.

Now, we work out the **current** drawn by the unit at 12VDC.

The formula you need is:

Current drawn (I) = Power (W) / Voltage of Battery (V)

Where:

I is the **current** drawn by the unit in amps

W is the **power** used by the unit in watts

V is the **voltage** used by the unit in volts

Let's select a power consumption of 10 W (the worst case) and run the **current** calculation.

I=W/V, so I=9/12 = 0.75 amps

Let's use a 12V, 4.2Ah battery with our transmitter. Now, we can run the **time** calculation.

H=Ah/I, so t=4.2/0.75 = 5.6 hrs.

09-40 Back Up Battery System

There are no backup batteries in this unit.

09-50 Overload Protection System

It is important to protect all electrical devices from overload conditions or reverse voltages. There are a number of devices that do this task for us.

- Fuses
- Circuit Breakers
- Sacrificial Components

09-51 Fuse System

In electronics and electrical engineering a **fuse** is a type of sacrificial over current protection device. Its essential component is a metal wire or strip that melts when too much current flows, which interrupts the circuit in which it is connected. Short circuit, overload or device failure is often the reason for excessive current.

There are no fuses inside the unit.

09-52 Circuit Breaker System

A **circuit breaker** is an automatically-operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to detect a fault condition and, by interrupting continuity, to immediately discontinue electrical flow.

Unlike a fuse, which operates once and then has to be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation.

There are no Circuit Breakers inside the unit.

09-53 Sacrificial Component System

A **sacrificial component** is a part of a machine or product that is intentionally engineered to fail under excess mechanical stress, electrical stress, or other unexpected and dangerous situations. The sacrificial part is engineered to fail first, and thus protect other parts of the system.

There are a series of sacrificial components located on the boards inside the device to protect it from excessive voltages or reverse polarity for example.

09-60 Grounding and Bonding

The case is bonded to the ground of the board.

09-70 Critical/Essential Power Bus

Not Required.

10 Start and Stop

10-00 General

You'll need to know how to start, stop and reboot the unit for normal operations. This section will describe all those procedures for you.

10-10 Starting the Unit

NanoVue receivers don't have power switches – you simply apply power to them and they will start up.

When power is applied to the NanoVue the screen will remain blank for about seven seconds while the unit boots up. This will be followed by a blue screen which will then show video if the corresponding transmitter is switched on.

Video is displayed to the left side of the screen in 4:3 aspect ratio.

The current preset, frequency and the unit's SNR values are displayed in the column to the right of the video.

10-10-01 Starting the NanoVue Receiver

You'll need a fully configured **NanoVue Receiver**.

1. Switch on the NanoVue Receiver using the procedure 9-10-01 or 9-20-01 above.
2. On the front screen, an image will appear.

10-10-02 Troubleshooting the Start

If **no images show**, check the power supply and check the power connections.

10-20 Shutting Down the Unit

It can be important to shut down a system gracefully. This ensures that all processes are terminated correctly and neither data nor settings are lost.

10-20-01 Shutting Down the SOLO4 Receiver

1. Disconnect the power cable from the NanoVue Receiver.
2. On the front screen, all images will disappear.
3. The system is shutdown safely.

11-Payload

11-00 General

The NanoVue Receiver forms part of a radio link designed to carry a **payload**. That payload can be any combination of **Video**, **Audio** and **Data**.

The NanoVue is designed to have everything you need to receive transmitted payloads in one compact unit.

You can also attach many types of devices to the NanoVue Receiver. Here are some examples:

- Monitors (Video)
- Headphones (Audio)
- GPS Monitors (Data)

You can of course connect video, audio and data at the same time to the receiver. The system simply shares out the available bandwidth between these services.

11-10 Video Payload System

Let's take the example of attaching a composite monitor to a NanoVue receiver. You might use this to view the video images being received from a remote transmitter.

11-10-01 Connecting a Video Monitor

You'll need a fully powered and configured **NanoVue Receiver**, a **CA0122 Audio Video Cable assembly** and a **monitor**.

1. Connect the **BNC 2-way plug** (male) on the CA0122 BNC Video Cable to your **Monitor**.
2. Now connect the **Lemo OB 5-way plug** (male) on the CA0122 BNC Video Cable to the **Lemo OB 5-way jack** (female) on the receiver.
3. Ensure the transmitter is operating on the correct frequency and has a video source.
4. **Switch on the receiver**.
5. You will now be receiving Video across the link.

11-20 Audio Payload System

Some cameras will also provide audio or in some cases you might want to just connect an audio source like a microphone to the transmitter. At the receiver you'll be able hear this asset using headphones or loudspeakers.

11-20-01 Connecting a Pair of Headphones

You'll need a fully powered and configured **NanoVue Receiver**, and a pair of **headphones.**

1. Connect the **TRS 3.5mm 3-way plug** (male) on the headphones cable to the TRS 3.5mm 3-way jack (female) on the NanoVue marked with a headphone symbol.
2. Ensure the transmitter is operating on the correct frequency and has an audio source.
3. **Switch on the audio device**.
4. You will now be receiving audio across the link.

11-30 Data Payload System

Sometimes you'll want to transmit data across the link. This might be the output of a GPS receiver or perhaps a temperature sensor attached to a soldier.

11-30-01 Connecting a Data Display

You'll need a fully configured **NanoVue Receiver**, a **CA0070 Data Cable assembly** and a **data display**.

1. Connect the **D-Type 9-way plug** (female) on the CA0070 Data Cable to the **data input** of your **data device**.
2. Now connect the **Hirose 3500 16-way plug** (male) on the CA0070 Data Cable to the **Hirose 3500 16-way jack** (female) on the NanoVue receiver.
3. Ensure the transmitter is operating on the correct frequency and has a data source.
4. **Switch on the data device**.
5. You will now be receiving data across the link.

11-31 Global Positioning System

Global positioning system (GPS) is a system that radio operators may be required to operate.

Global positioning system is a space-based navigation system designed to provide 24-hour continuous worldwide, all-weather precise position, and time measurement.

The GPS consists of a space segment (satellite), control segment (monitors stations on Earth), and user segment (GPS receivers).

The system operates by satellites sending out two signals on non-changing frequencies. The GPS receiver receives the signals transmitted by the satellites and computes the user's position.

GPS (by being an all-weather, jam-resistant, continuous system) gives users highly accurate navigation; worldwide, three-dimensional position or location velocity; and time information.

As a passive, receive-only system, GPS can be employed at the individual level in such nondescript terrain as jungles, mountain ranges, or deserts.

11-40 Internet Protocol (IP) Payload System

The NanoVue has an Ethernet connection which is used to configure the unit from your PC using your browser software and the units control pages. This connection can also be use to stream video from the NanoVue.

11-40-01 Connecting an IP System

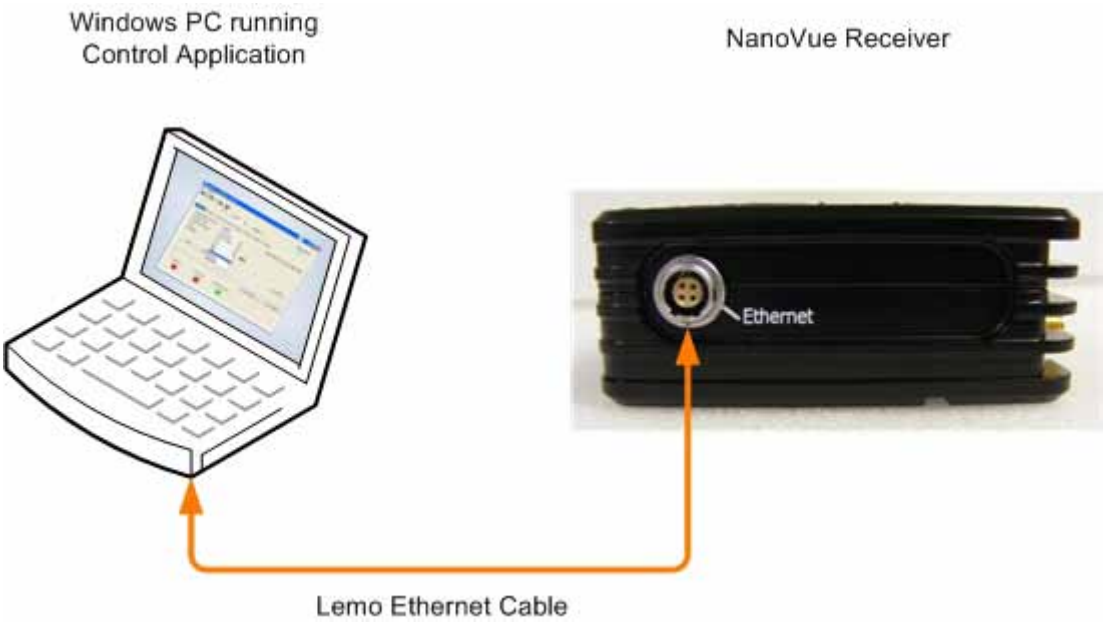
You'll need a fully configured **NanoVue Receiver,** a **Lemo Ethernet Cable and a PC with a browser.**

1. Connect the **RJ45 8-way plug** (male) on the Lemo Ethernet Cable to the **RJ45 8-way jack** of your **Personal Computer**.
2. Now connect the **Lemo OB 4-way plug** (male) on the Lemo Ethernet Cable to the **Lemo OB 4-way jack** (female) on the NanoVue receiver.

12 Control Application

12-00 General

The NanoVue Receiver has **Control Pages** accessed from your web browser which enables you to perform many configuration tasks quickly and easily. This section tells you how to connect your PC to the receiver and then use your browser to configure the unit.



12-10 Control Application System

You install a **browser** (Internet Explorer or Firefox for example) onto your Personal Computer (PC). Then, you connect the personal computer to your NanoVue using the Lemo Ethernet Cable Assembly.

Now you can start the browser and connect to the Control Application and begin configuring your NanoVue Receiver.

Remember, the NanoVue receiver is very simple to operate using its touch screen control panel after it has been fully configured using the control software.

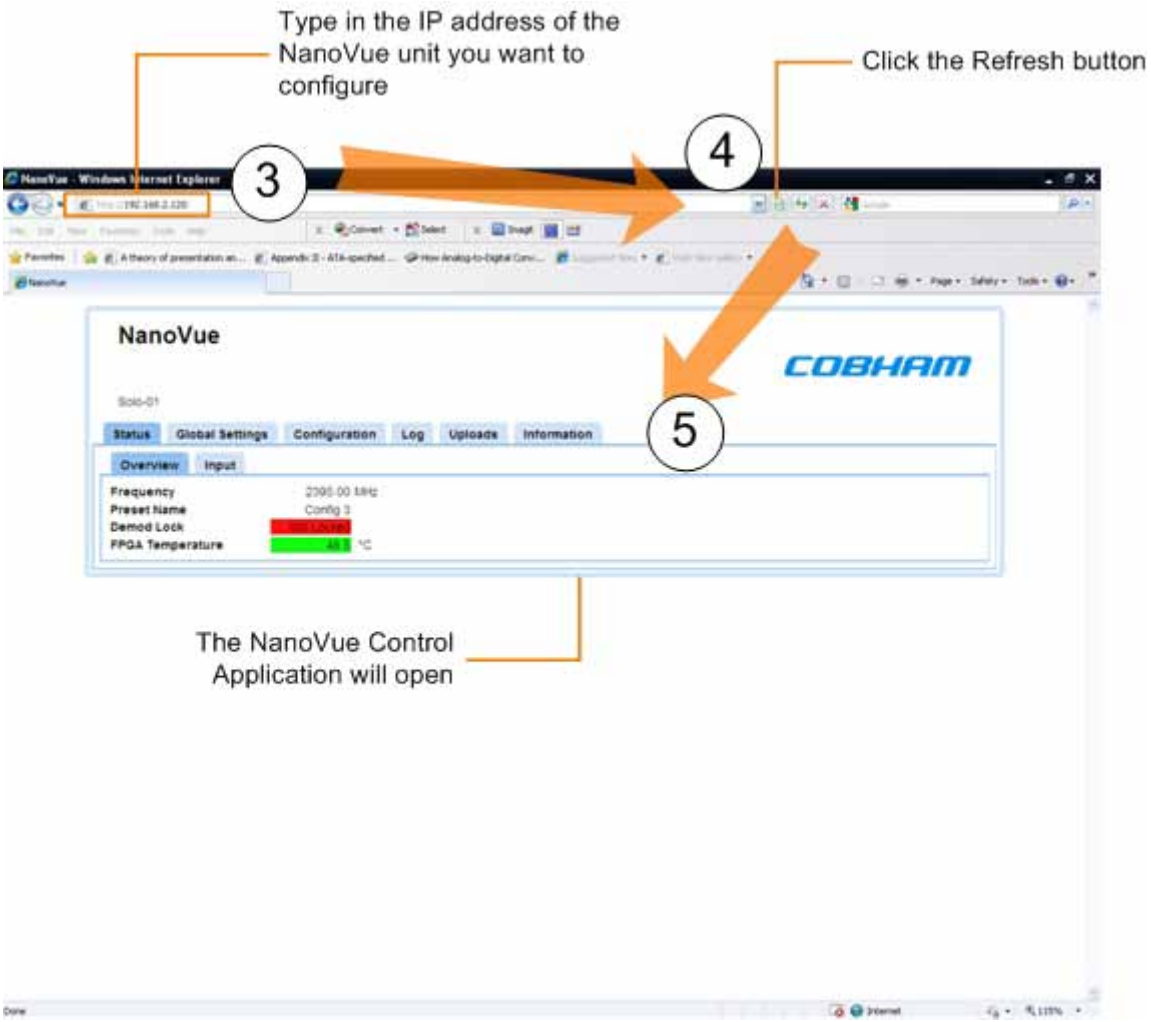
12-10-01 Connecting to a Personal Computer

You'll need a fully configured **NanoVue Receiver,** a **Lemo Ethernet Cable and a PC with a browser.**

1. Connect the **RJ45 8-way plug** (male) on the Lemo Ethernet Cable to the **RJ45 8-way jack** of your **Personal Computer**.
2. Now connect the **Lemo OB 4-way plug** (male) on the Lemo Ethernet Cable to the **Lemo OB 4-way jack** (female) on the NanoVue receiver.

12-10-02 Starting the Control Application

1. Click Start ® Internet on the PC.
2. Your **browser window** will open.
3. Type the **IP address** of the NanoVue you want to configure like this example: **http://192.168.2.1/**
4. Click the **Refresh** button.
5. The web browser opens the first **Control Page** of the NanoVue.



12-20 Control Application Window System

The Control Application has **one** principal window.

- The **NanoVue Control** window

12-21 NanoVue Control Pages System

This is the **Primary** page of the Control Pages. This is where you can perform all the **basic setup**.

12-21-01 Opening the NanoVue Control Window

The **NanoVue Control Pages** open when the web browser connects to the NanoVue. It starts at the **Status** tab on the **overview** sub-tab.

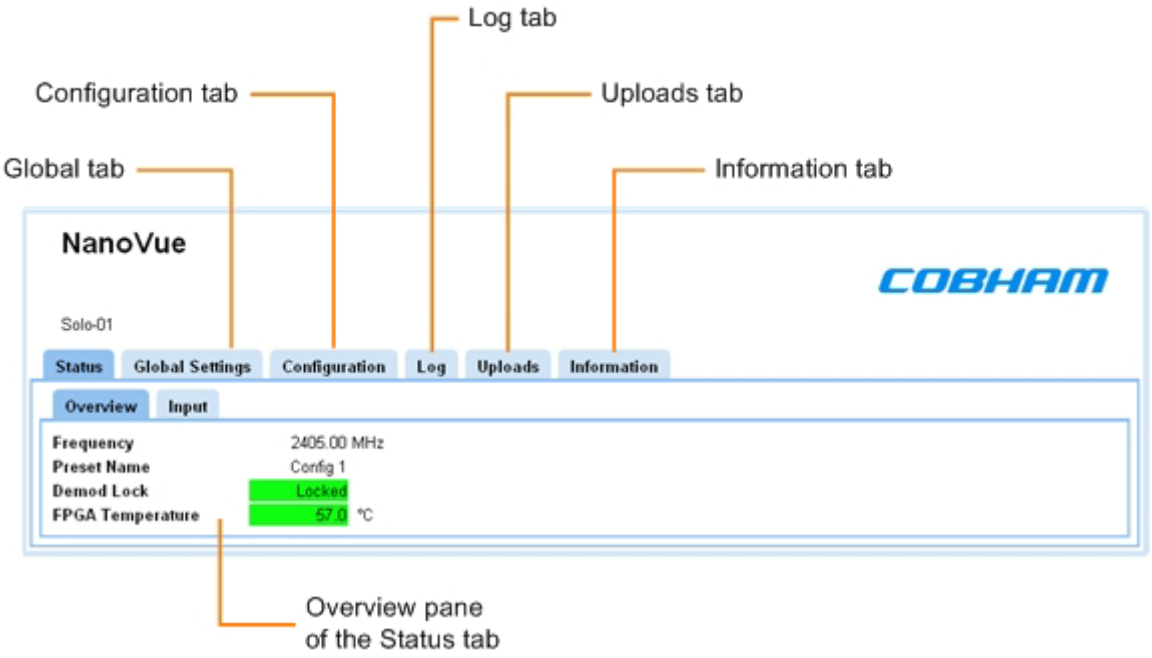


Figure 12-21-01 - NanoVue Receiver Control Window

12-22 NanoVue Tab System

The NanoVue Control Window is divided into **six** tabs:

- Status tab
- Global Settings tab
- Configuration tab
- Log tab
- Uploads tab
- Information tab

12-23 Status Tab System

This displays detailed status information of received signal quality and decoded video and audio services.

The Status tab is divided into these sub-tabs:

- Overview
- Input

12-23-01 Opening the Overview Sub-tab

Click on **Status** ® **Overview** tab to open the Status/Overview page:

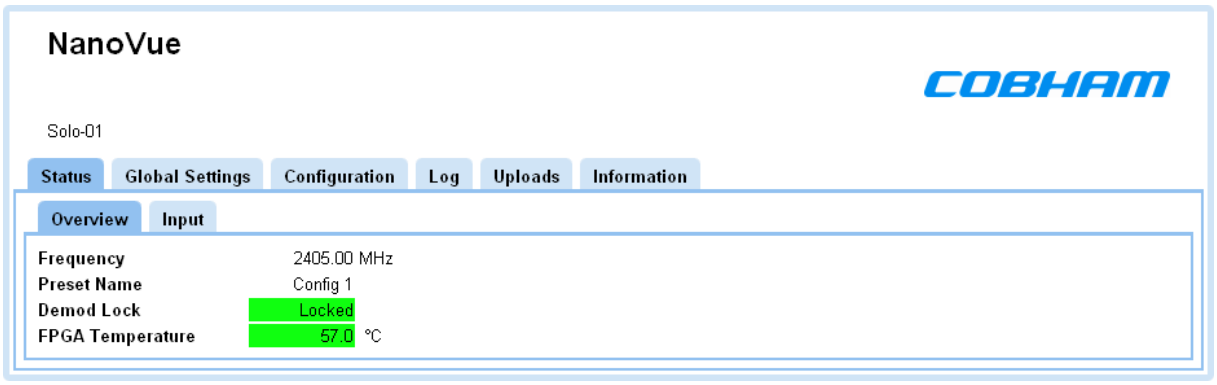


Figure 12-23-01 - Status / Overview Tab

Unit Parameter	Options	Notes
Input frequency (MHz)	L, S and C Bands	The **frequency** in megahertz (MHz) to which the receiver is tuned.
Preset Name	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	This is the configuration you are currently working on. Only 1 to 16.
Demod Lock Status	Locked or Not Locked	Tells you if the unit has successfully demodulated the incoming RF.
FPGA Temperature	Any temperature	This field reports the current temperature of the FPGA in degrees Celsius. If the field background is green, the temperature is within limits. If the background shows red, then the FPGA is overheating and the unit should be switched off immediately. It should be in the region of 50 to 80 degrees Celsius.

12-23-02 Opening the Input Sub-tab

Click on **Status** ® **Input** tab to open the Status/Input page:

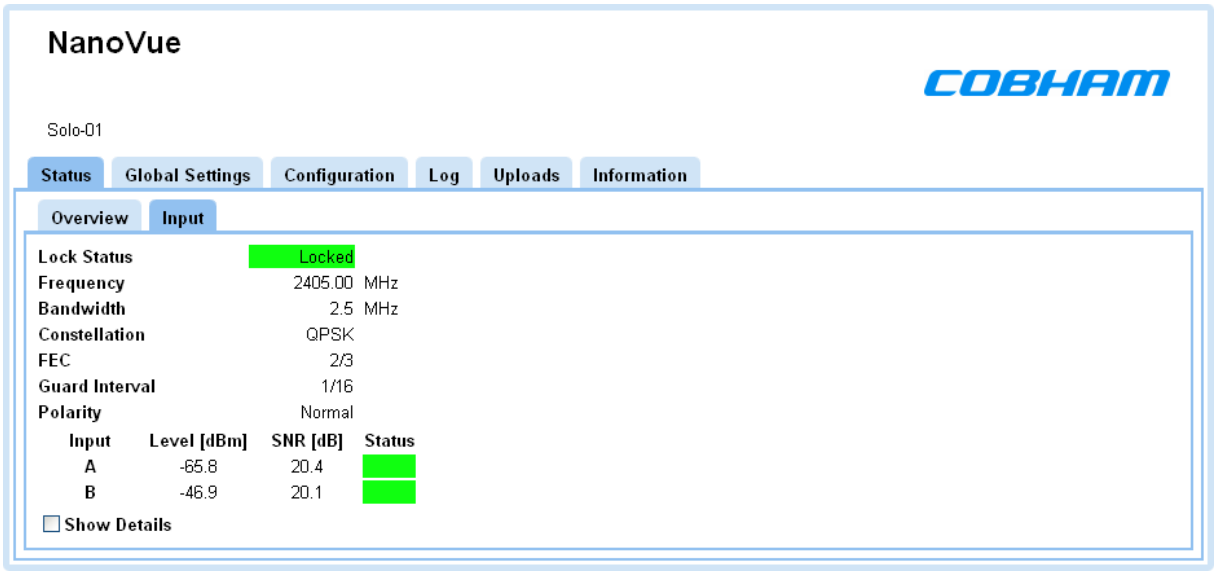


Figure 12-23-02 - Status / Input Tab

Unit Parameter	Options	Notes
Decoder Lock Status	Locked (steady green background) or Not Locked (steady red background.	Tells you if the unit has successfully locked to the incoming bit stream.
Input frequency (MHz)	L, S and C Bands	The frequency in megahertz (MHz) to which the receiver is tuned.
Bandwidth	DVBT:6, 7 & 8MHz Narrowband: 2.5MHz 1.25MHz and 625kHz	DVB-T bandwidths (normally used for broadcast) Cobham narrowband (normally surveillance use) Cobham Ultra-narrowband (this is a licensable feature, normally surveillance use)
Constellation	QPSK, 16QAM, 64QAM	This field indicates the OFDM constellation being received. QPSK-less user data, more robust, more range. 16QAM-more user data, less robust, less range. The mode is automatically detected and is simply

		displayed here. You can't change it other than at the transmitter.
FEC	1/3 or 2/3	This field indicates the forward error correction (FEC) rate which is being applied. 1/3-less user data, more FEC data, more robust, more range. 2/3-more user data, more FEC data, less robust, less range. The mode is automatically detected and is simply displayed here. You can't change it other than at the transmitter.
Guard interval	Narrowband: 1/16 or 1/8 DVBT: 1/32, 1/16, 1/8, 1/4	The guard interval which is being applied to the narrowband mode in use. The guard interval is a deliberate extension of the RF symbol period to give immunity to reflections. 1/16, short extension, deals with fast reflections, more data, less range. 1/8, long extension, deals with slower reflections, less data, more range.
Polarity	Normal or Inverted	All Cobham equipment should use normal mode. The receivers can be used with other manufacturer's products and sometimes this requires us to change the polarity to inverted to match this third party equipment.
Input Level A		The level in dBm of the signal being received on antenna A

		There are readings for both antennas.
Input A SNR	Could be any number.	The signal to noise ratio of the signal being received on antenna A. There are readings for both antennas.
Status	Green or Red	A visual indication of signal strength.

12-23-03 Show Detail Check Box

When checked, the extra details about the error corrector on this page are displayed.

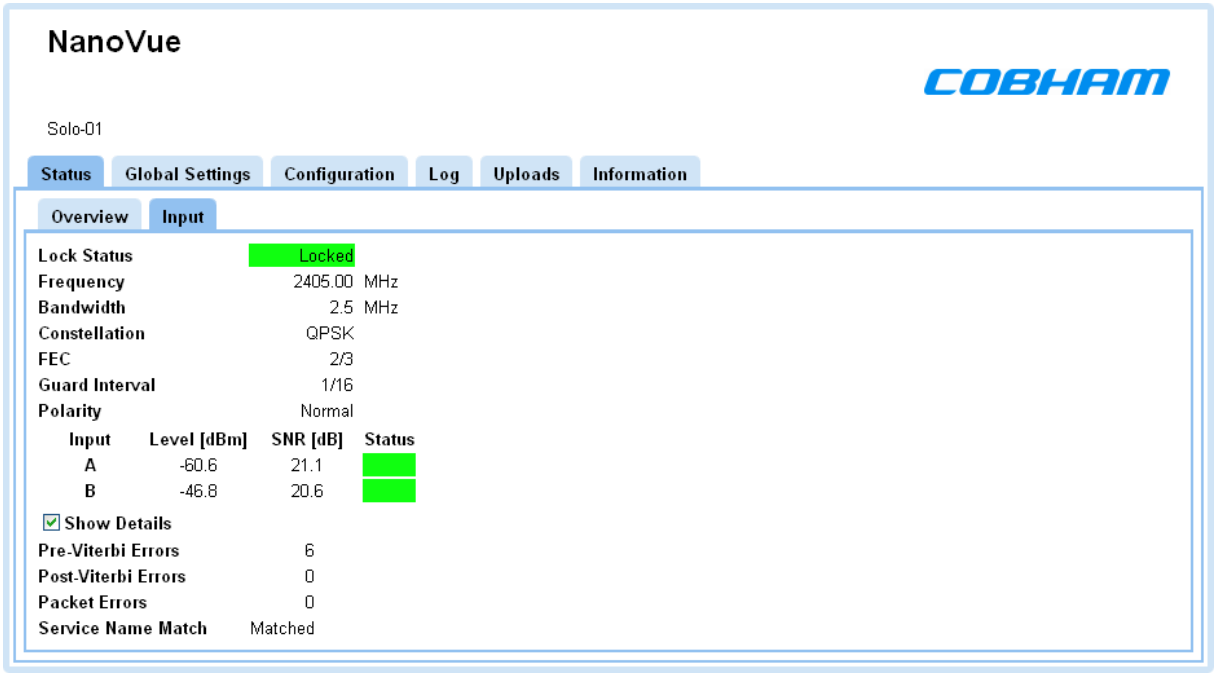


Figure 12-23-03 - Status / Input Tab with extra fields

Unit Parameter	Options	Notes
Pre-Viterbi Errors	0 is ideal. Could be any number.	The bit error rate for pre-errors.
Post-Viterbi Errors	0 is ideal. Could be any number.	The bit error rate for post-errors.
Packet Errors	0 is ideal. Could be any number.	The number of packet errors coming out of the error correction system.

		Any error here will corrupt the video, audio or data signals coming through the receiver.
Service Name Match	Matched	Reports that the Service name set on the transmitter matches the service name set at the receiver.

12-24 Global Settings Tab System

The Global Settings tab contains parameters that control global unit features common to all presets, including network parameters and OSD configuration.

The Global Settings tab is divided into these panes:

- General Settings
- OSD Settings
- Streaming Settings

12-24-01 Opening the Global Settings Tab

Click on the **Global Settings** tab to open the page:

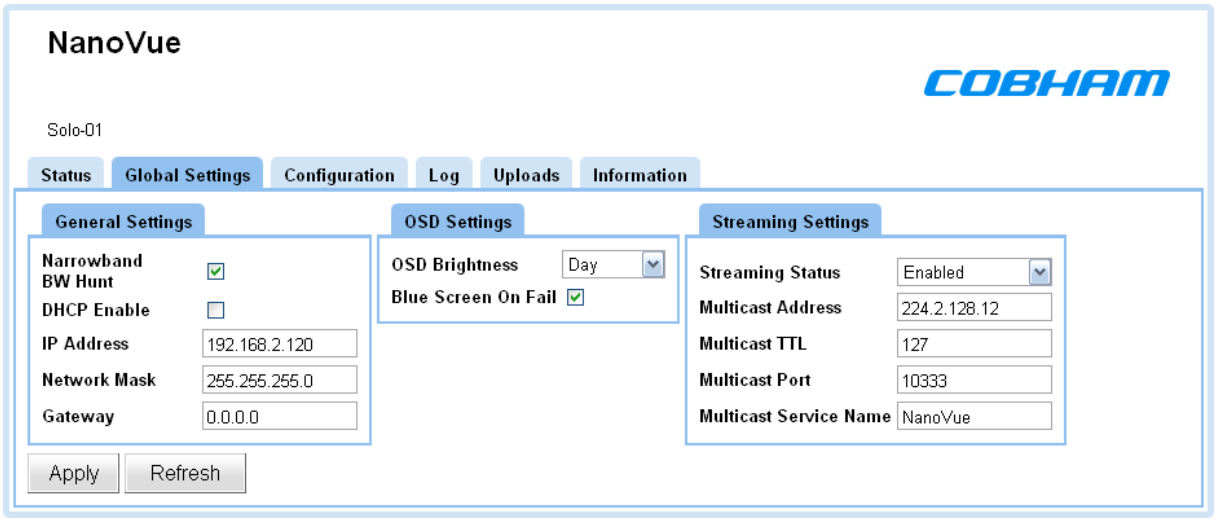


Figure 12-24-02 – Global Settings Tab

12-24-02 General Settings Pane

Unit Parameter	Options	Notes
Narrowband Bandwidth Hunt	Checked or unchecked	When Bandwidth Hunting is checked, and the unit is in Narrowband mode, NanoVue will automatically change its bandwidth to match that of the transmitter, providing the unit is licensed for both 1.25MHz and 2.5MHz.
DHCP Enable (Dynamic host configuration protocol)	Checked or unchecked	When checked the NanoVue is given an IP address by an external DHCP server. In managed networks which use DHCP address allocation this option should be selected. In networks that are manually managed (or do not feature a DHCP server), users may prefer to assign an IP address manually.
IP Address	Example: 192.168.2.120	If the NanoVue is not automatically acquiring its IP address via a DHCP server then a fixed IP address needs to be assigned to the unit Enter an **IP address** for this NanoVue in the IP address text box. It can be any class of network you choose.
Network Mask	Example: 255.255.255.0	The network mask allows a network administrator to break a network into smaller more efficient subnets to prevent excessive numbers of IP packets being routed through the network. This is normally defined by the network administrator

		Enter a **subnet mask** in the Network mask text box.
Gateway	Example: 192.168.2.120	A default gateway is used by a host when an IP packet's destination address belongs to someplace outside the local subnet. The default gateway address is usually an interface belonging to the LAN's border router. We recommend you leave the gateway at the same setting as the IP Address.

12-24-03 OSD Settings

Unit Parameter	Options	Notes
OSD Brightness	Day or Night	Day setting gives a brighter screen than Night setting.
Blue Screen on Fail	Checked or unchecked	Select Checked (on) or unchecked (off) from this checkbox to decide what happens when the video signal can no longer be decoded. ON – The screen will display a blue screen OFF – The screen will show a freeze frame of the last image it was able to decode.

12-24-04 Streaming Settings

Unit Parameter	Options	Notes
Streaming Status	Off or On	Switches the streaming on or off.
Multicast Address	224.2.128.12	This text box enables you to change the multicast address used by the unit.

		The default value is 228.2.128.12.
Multicast TTL	1 to 255 Default is 127	This is the multicast time to live value. Default 127.
Multicast Port	10333 Range available is 1024-65535	Protocols like TCP or UDP use port numbers in the header to direct traffic around the network. Low port numbers are used by computer systems for predefined tasks. For example SMPT (for your email service) uses port 25. A good rule is to use numbers above 10,000 to avoid conflict with existing services. When you set up a port number on several computers on a network they will all listen for packets directed to that port. The default value is 10333.
Multicast Service Name	NanoVue or any eight ASCII characters.	The default is NanoVue. This is an identifier for the service.

12-24-05 Apply

Each time you change any parameter on the Control Application it is **very important** to click the **Apply** button and wait for a moment for the changes to be sent to the device.

Many times people change a parameter and then wonder why the device has not changed behaviour. **Always** click the **Apply** button.

12-24-06 Refresh

If the **Polling is enabled** then the software **will check** with the device every few seconds so it can update the Control Pages with the latest configuration changes.

Sometimes, you may choose to leave **polling off**. To update the Window in this case you'll need to click the **Refresh Button** to see the latest changes.

12-25 Configuration Tab System

The Configuration tab contains the list of 16 presets. Each preset the user can specify demodulation parameters, decoding modes, and descrambling configuration.

You can easily load a different preset by selecting one of the 16 configuration tabs and clicking **Apply**.

The **live** preset is indicated by a **green box** around the preset number.

Changes to the live preset are automatically applied with the **Apply** button. Changes made to all other non-live presets can be saved by clicking on **Save**.

The Configuration tab is divided into:

- Demod
- Decoder
- Encryption

12-25-01 Opening the Configuration Tab

Click on the **Configuration** tab to open the page:

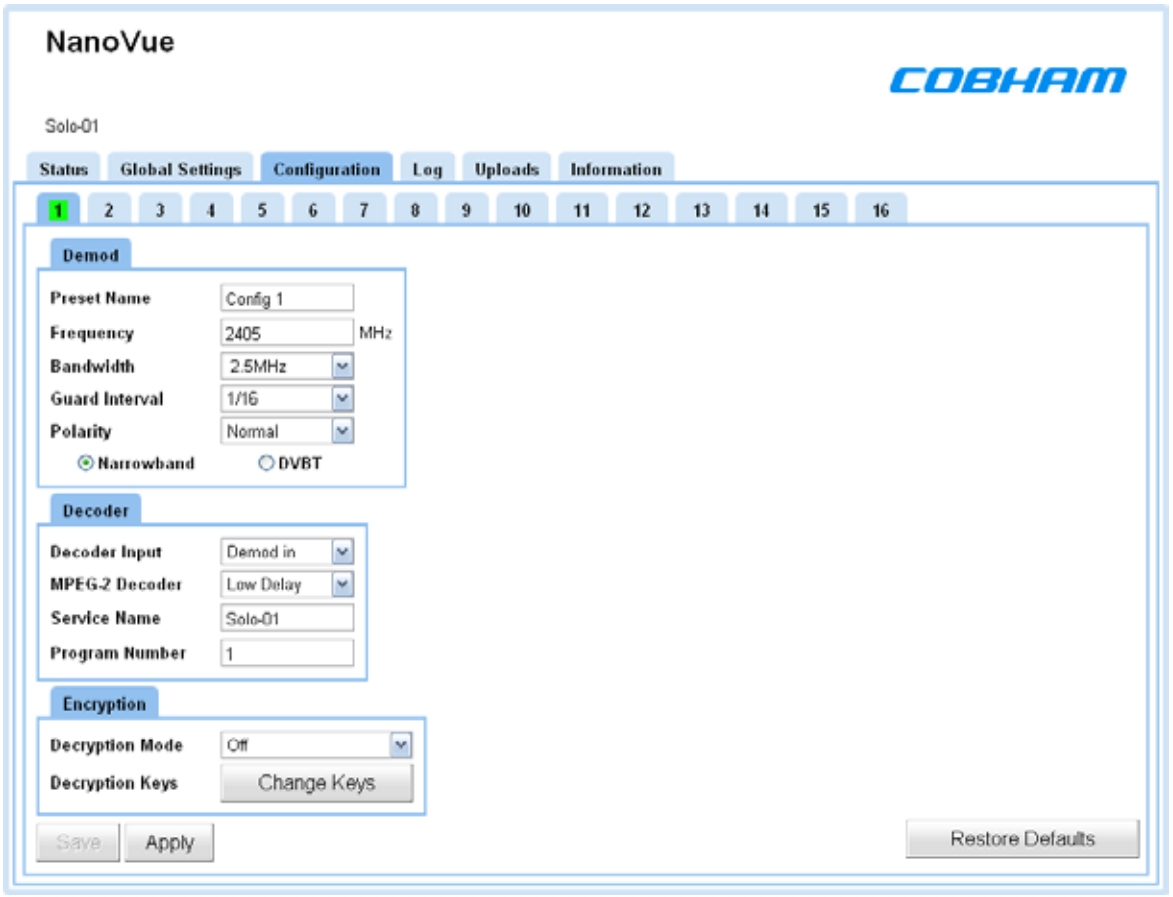
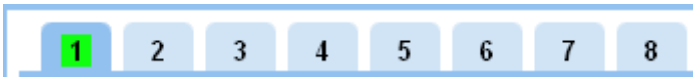


Figure 12-25-01 – Configuration Tab

12-25-02 Tabs 1 to 16



The **darker blue** tab shows the preset you are currently **editing**.

The **green box** shows which preset is currently **active** in the receiver.

In the example above, preset one is both active and available for editing.

12-25-03 Demod

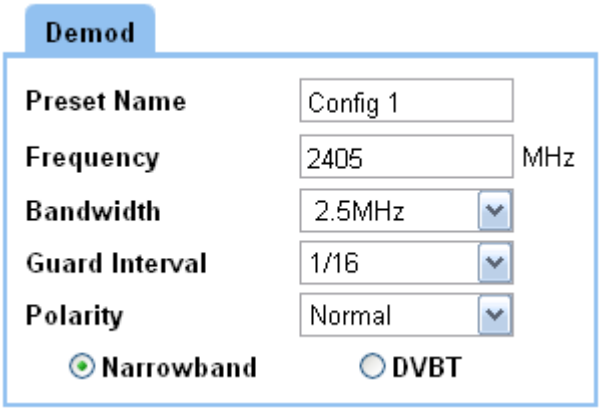


Figure 12-25-03 – Demod Sub Pane

Unit Parameter	Options	Notes
Preset Name	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	This is where you **set** the current configuration. Only 1 to 16.
Input frequency (MHz)	L, S and C Bands	The frequency in megahertz (MHz) that you want to use for this preset. If you try to input a frequency that is out of range, the radio will tune the lowest available frequency automatically.
Bandwidth	DVBT:6, 7 & 8MHz Narrowband: 2.5MHz 1.25MHz	DVB-T bandwidths (normally used for broadcast) Cobham narrowband (normally surveillance use) Cobham Ultra-narrowband (this is a licensable feature, normally surveillance use)

Guard interval	Narrowband: 1/16 or 1/8 DVBT: 1/32, 1/16, 1/8, 1/4	The guard interval which is being applied to the narrowband mode in use. The guard interval is a deliberate extension of the RF symbol period to give immunity to reflections. 1/16, short extension, deals with fast reflections, more data, less range. 1/8, long extension, deals with slower reflections, less data, more range.
Polarity	Normal or Inverted	All Cobham equipment should use normal mode. The receivers can be used with other manufacturer's products and sometimes this requires us to change the polarity to inverted to match this third party equipment.

12-25-04 Bandwidth Mode

This pair of radio buttons enables you to select between Narrowband and DVBT modes. If you select narrowband then the narrowband radio settings apply. If you select DVBT then the DVBT radio settings come alive.

12-25-05 Decoder

Unit Parameter	Options	Notes
Decoder Input	Demod In or Chaining In	The decoder either works with the received radio signal (default) or decodes data arriving at the data port on the 13-way Amphenol.
MPEG-2 Decoder	Low Delay or Fully Compliant	These modes only apply to DVB-T modes.
Service Name	Solo-01 is default but could be anything.	The MPEG name for the stream. Should match the transmitter's service name.
Program Number	1	First program in the stream.

12-25-06 Encryption

Unit Parameter	Options	Notes
Decryption Mode	Off, EBS, AES128, AES128+, AES256, AES256+, BCrypt, BCrypt+, BCrypt256, BCrypt256+	Select the mode which has been used to scramble the signal at the transmitter.
Decryption Keys	Change Keys Button 	Click this button to open the **Enter Scrambling Key** dialog box.

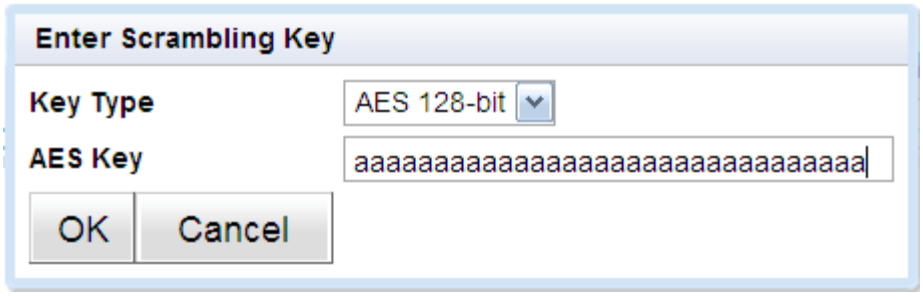


Figure 12-25-05 – Enter Scrambling Key Dialog

12-25-07 Restore Defaults

Clicking this button sets all of the fields back to a **factory default** condition. You will get an Are you sure message before you commit to this change.

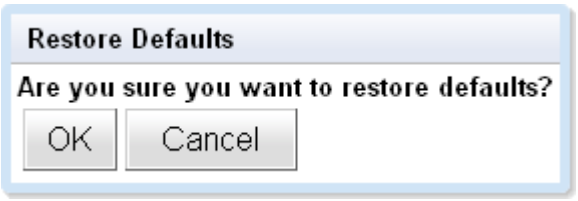


Figure 12-25-06 – Restore Defaults Dialog

12-25-08 Save

Clicking the **Save** button saves the current preset in the unit.

12-25-09 Apply

Each time you change any parameter on the Control Application it is **very important** to click the **Apply** button and wait for a moment for the changes to be sent to the device.

Many times people change a parameter and then wonder why the device has not changed behaviour. **Always** click the **Apply** button.

12-26 Log Tab System

The NanoVue receiver has the facility for generating log files of receiver status information (available in software v1.3).

12-26-01 Opening the Log Tab

Click on the **Log** tab to open the page:

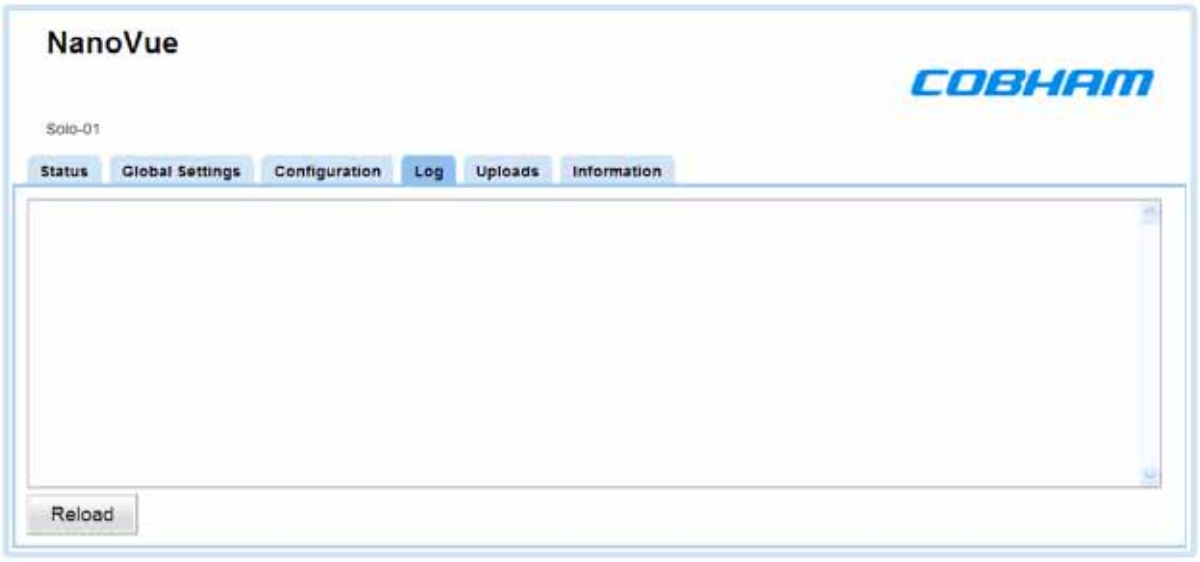


Figure 12-26-01 – Log Tab

12-26-02 About the Log Tab

The log tab gives you a textual display of events with time information. The events logged include stream errors and software updates processed.

12-26-03 Reload Button

Click the Reload button to force a reload of the page data.

12-27 Uploads Tab System

This page enables you to upload a license file, enable licensable features, or send software upgrade files to the NanoVue.

12-27-01 Opening the Uploads Tab

Click on the **Uploads** tab to open the page:

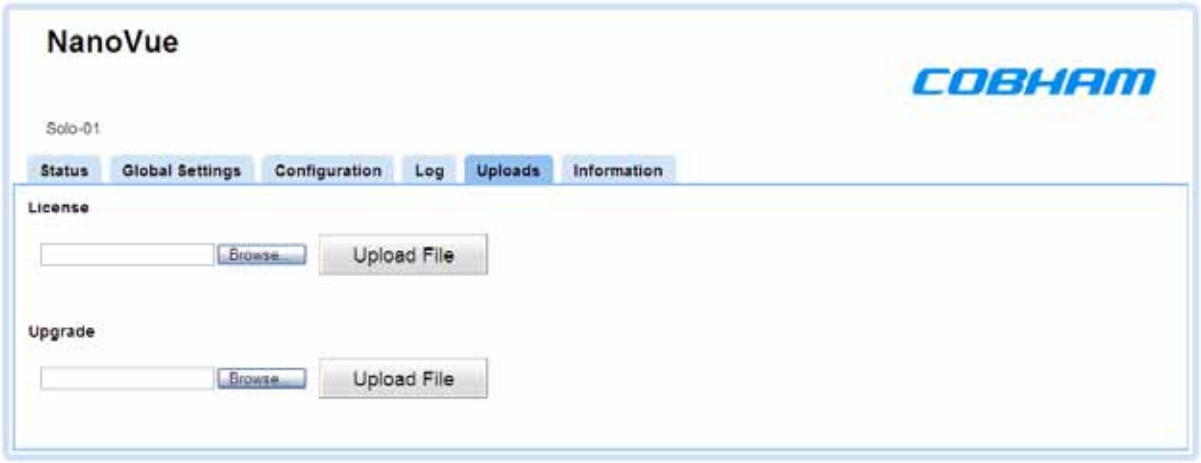


Figure 12-27-01 – Uploads Tab

12-27-02 Licence

If a new licensable feature is purchased for a unit then a new license code has to be programmed into the NanoVue to enable the function.

Cobham will generate a new license file (with the file extension .lic) which we'll send to you.

1. Open the **Uploads** Tab
2. Click the **Browse** button next to the **Licence** text box
3. The **Choose File to Upload** window opens
4. Navigate to the .lic file we sent you
5. Click **Open**
6. Check the **correct file** is shown in the **Licence** text box
7. Click **Upload File**
8. The licence is written to the unit, you'll see a **message**
9. After rebooting the unit, the new features will be enabled

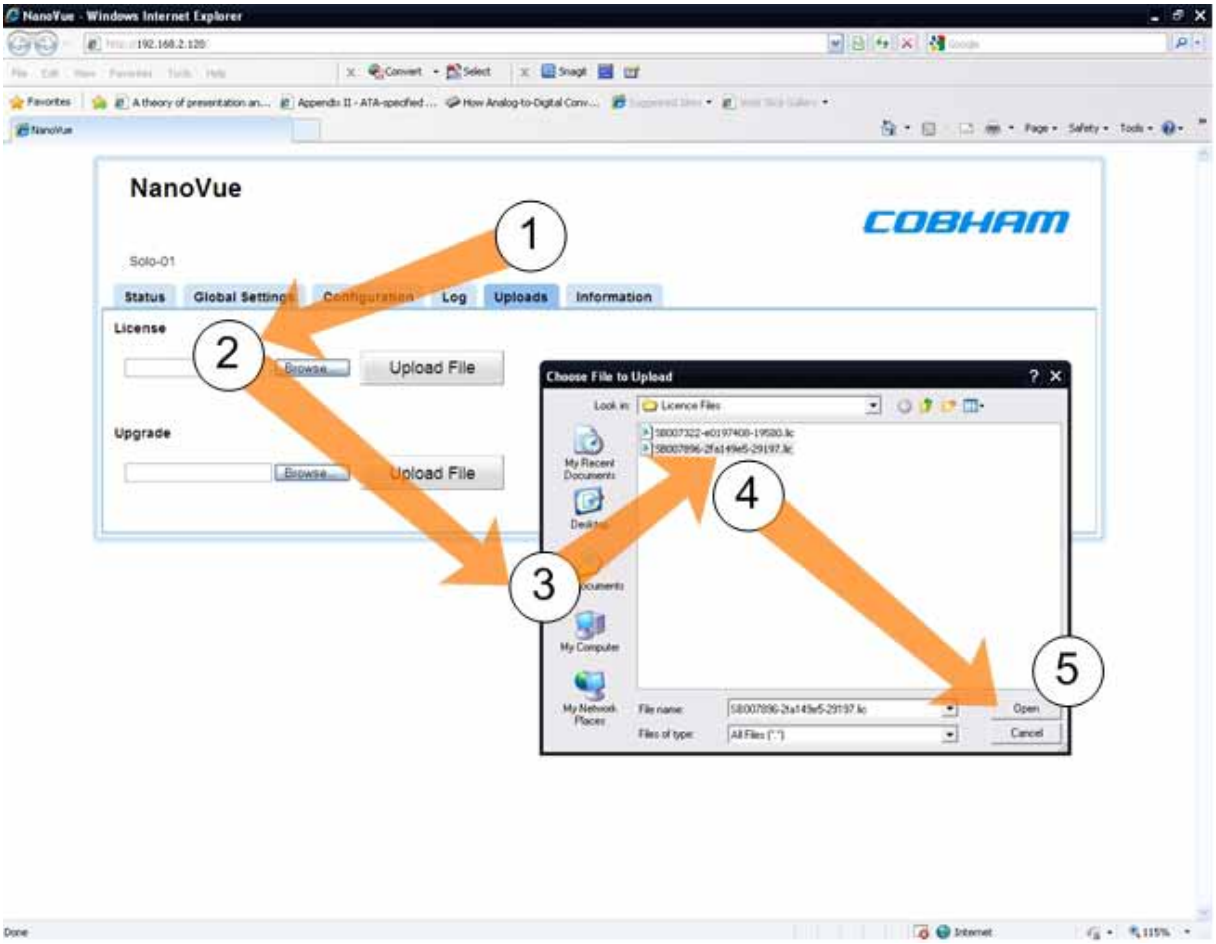


Figure 12-27-02 – Uploading a Licence

12-27-03 Upgrade

When a new software release is available for the NanoVue, Cobham will supply customers with a software upgrade.

Cobham will generate a new upgrade file (with the file extension .upg) which we'll send to you.

1. Open the **Uploads** Tab
2. Click the **Browse** button next to the **Upgrade** text box
3. The **Choose File to Upload** window opens
4. Navigate to the .upg file we sent you
5. Click **Open**
6. Click **Upload File –** it will take about five minutes.
7. The upgrade is applied to the unit, you'll see a **message**
8. After rebooting the unit, the new features will be enabled

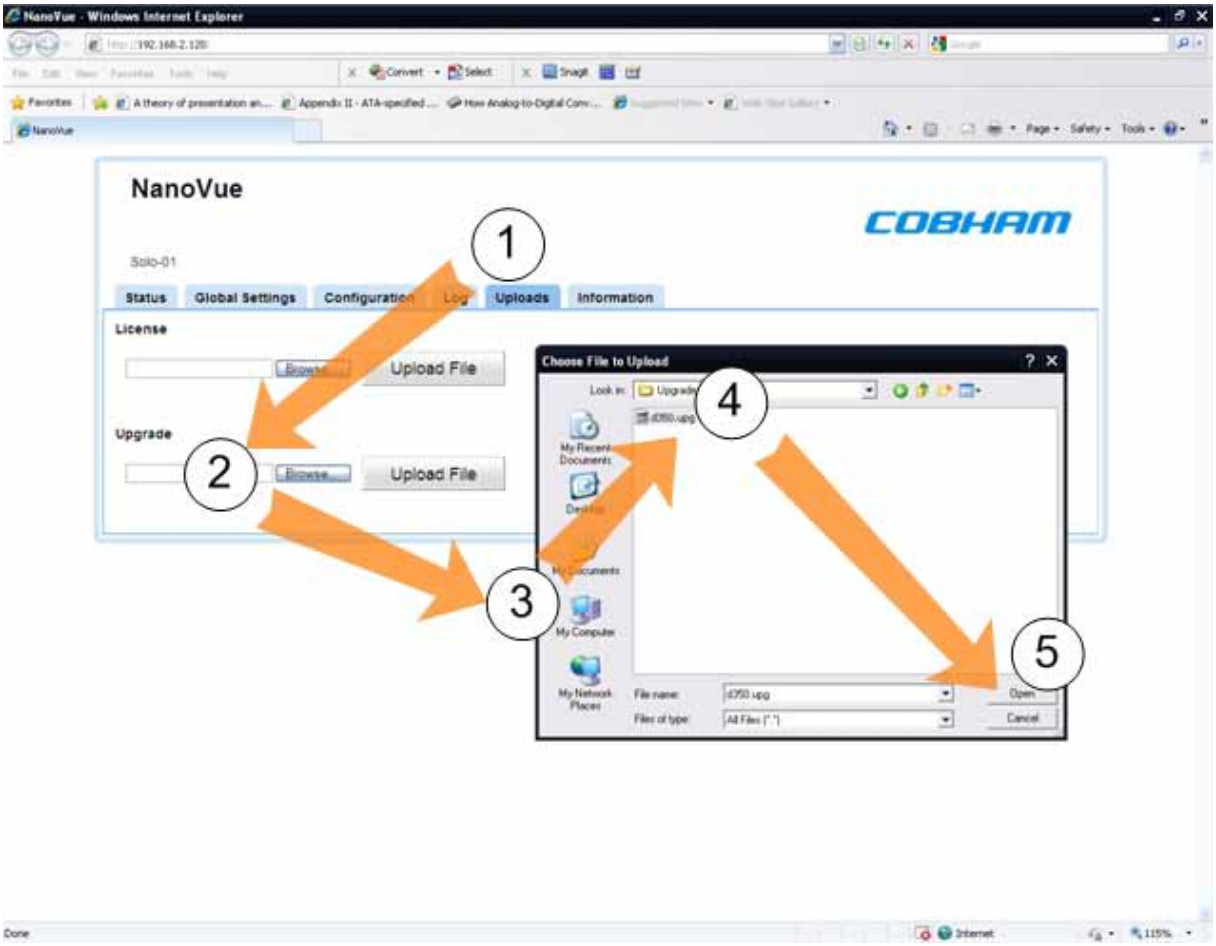


Figure 12-27-03-001 – Uploading an Upgrade

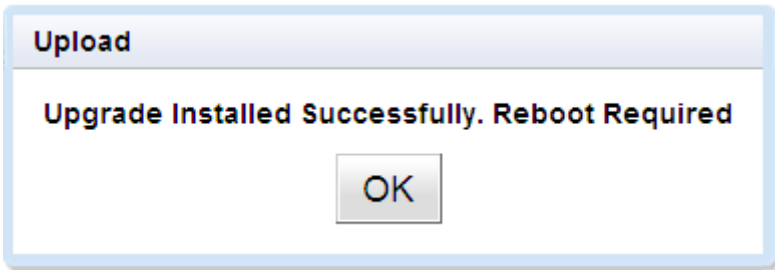


Figure 12-27-03-002 – Upgrade success and reboot message

12-28 Information Tab System

The Information tab contains generic information including software versions and unit specific data. You'll need this information during a support call for example.

12-28-01 Opening the Information Tab

Click on the **Information** tab to open the page:

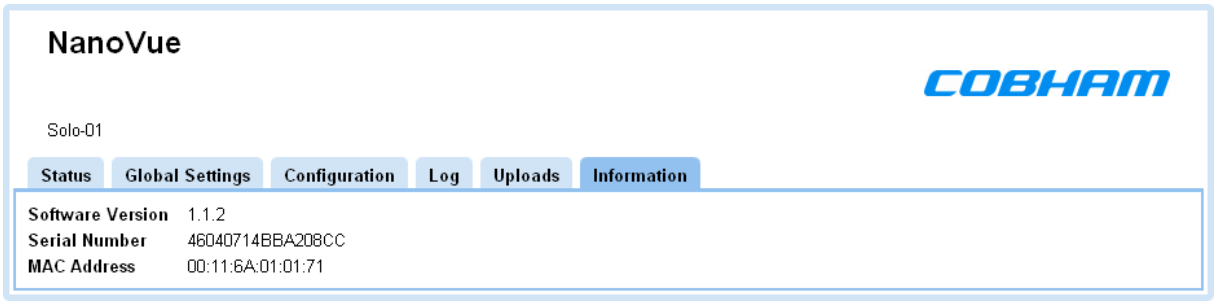


Figure 12-28-01 – Information Tab

12-28-02 Software Version

This field returns the current version of software loaded onto the NanoVue unit. When you do an upgrade, you'll probably want to check here to see that the upgrade went well.

12-28-03 Serial Number

During a support call we'll often ask you for the Serial Number of your NanoVue. This is where you find it.

12-28-04 MAC Address

Media Access Control Address (MAC) is reported by this field. You may need this if you are involved in network operations with your NanoVue.

13-Encryption

13-00 General

The target is focused on intercepting your radio signal. To do this, all that they need is a radio receiver that operates in the same mode and on the same frequency you are using to transmit. The mere fact that you are operating gives them valuable information. It tells them that you are in the area and by the number of stations operating on the same frequency they can estimate the size of the operation against them. If your radio net is operating in the clear, the target specialists can see or hear exactly what is being transmitted for even more information. When analysing the traffic patterns, the target can work out which station is the net control station and identify the headquarters.

13-10 Encryption System

If the AES scrambling option has been purchased for the SOLO system in use, then it is possible to encrypt the link. Both AES128 and AES256 are licence-controlled features. You'll need to encrypt the traffic leaving the transmitter and set up the receiver for decrypt.

Note: The word **Encryption** applies to the whole process of encryption and decryption. We'll just use the word encryption for this receiver manual even though what is actually going on here is a decryption process.

13-10-01 Switching on the NanoVue Receiver Encryption

Here's how you set up **Encryption** on the device:

1. Click on the **Configuration** tab to open the page:
2. In the **Decryption Mode** drop-down box click the drop-down arrow and select an encryption type. (AES128 for example).

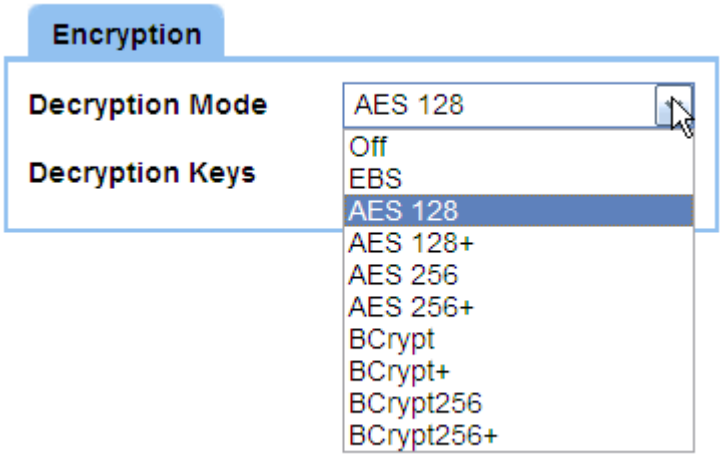


Figure 13-10-01 – Selecting the Decrypt Mode

13-10-02 Changing the Encryption Key

The **encryption key** is a 128bit value for AES128 and a 256bit value for AES256, and is entered as 32 or 64 ASCII hexadecimal characters (0..9, A..F).

1. Click on the **Configuration** tab to open the page
2. Click the **Change Keys** button.
3. The **Enter Scrambling key** dialog box will open
4. In the **Key type** drop-down box click the drop-down arrow and select the key type you are trying to write. (Should match the key type you chose in 13-10-01).
5. In the **AES128 key** text box, type the encryption key you want to use.
6. Click the **OK** button.

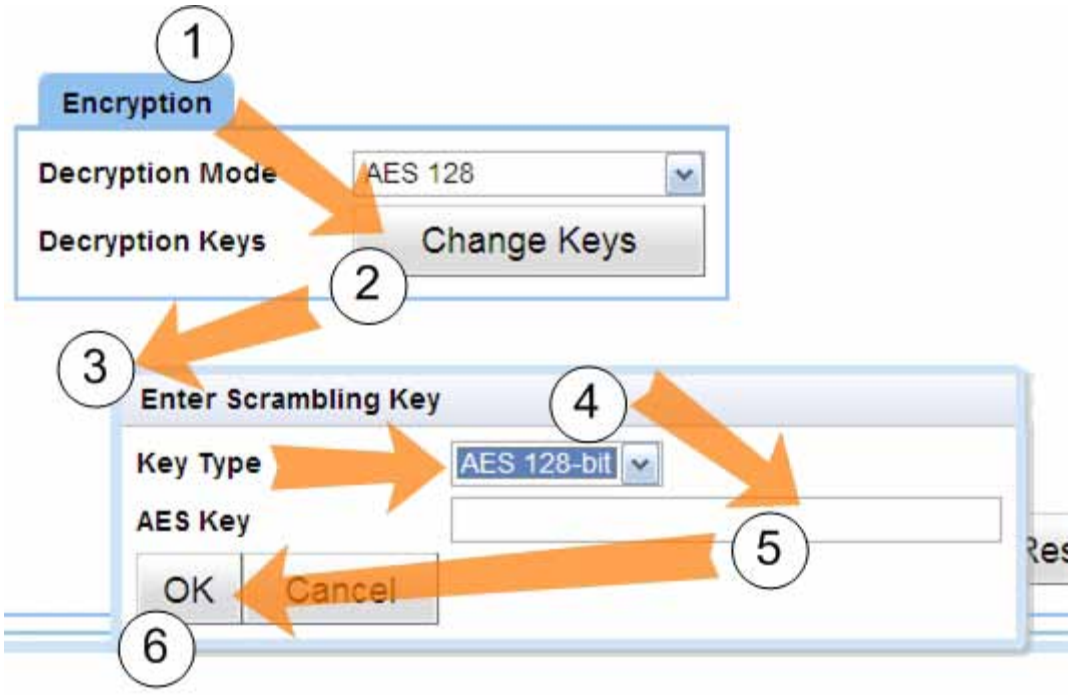


Figure 13-10-02 – Changing the Encryption Key

13-10-03 Number of Encryption Key Characters Required

In our example above we used AES128 encryption. This needed a key of 32 characters. If we had chosen AES256 it would need a 64 character key which we spread over two fields like this:

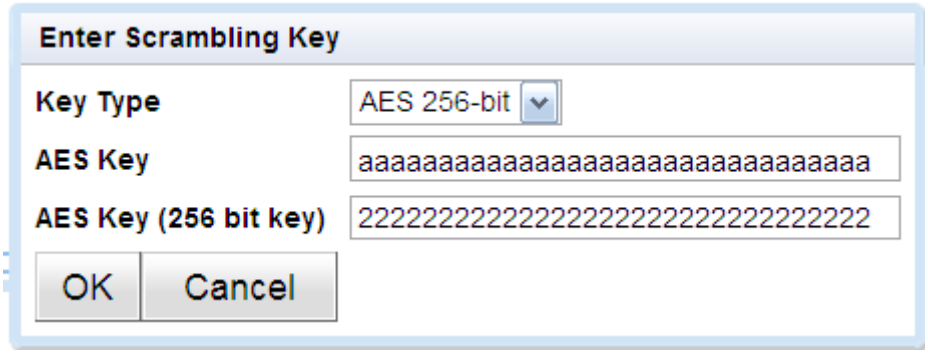


Figure 13-10-03 – Enter Scrambling Key Dialog for AES256 key Type

Key Type	Number of Characters Needed
EBS	8
AES128	32
AES256	64 (32 in each field)

15-Accessories

15-10 NanoVue Clip-on Rechargeable Battery System

15-10-01 Clip-on Rechargeable battery – Rear View

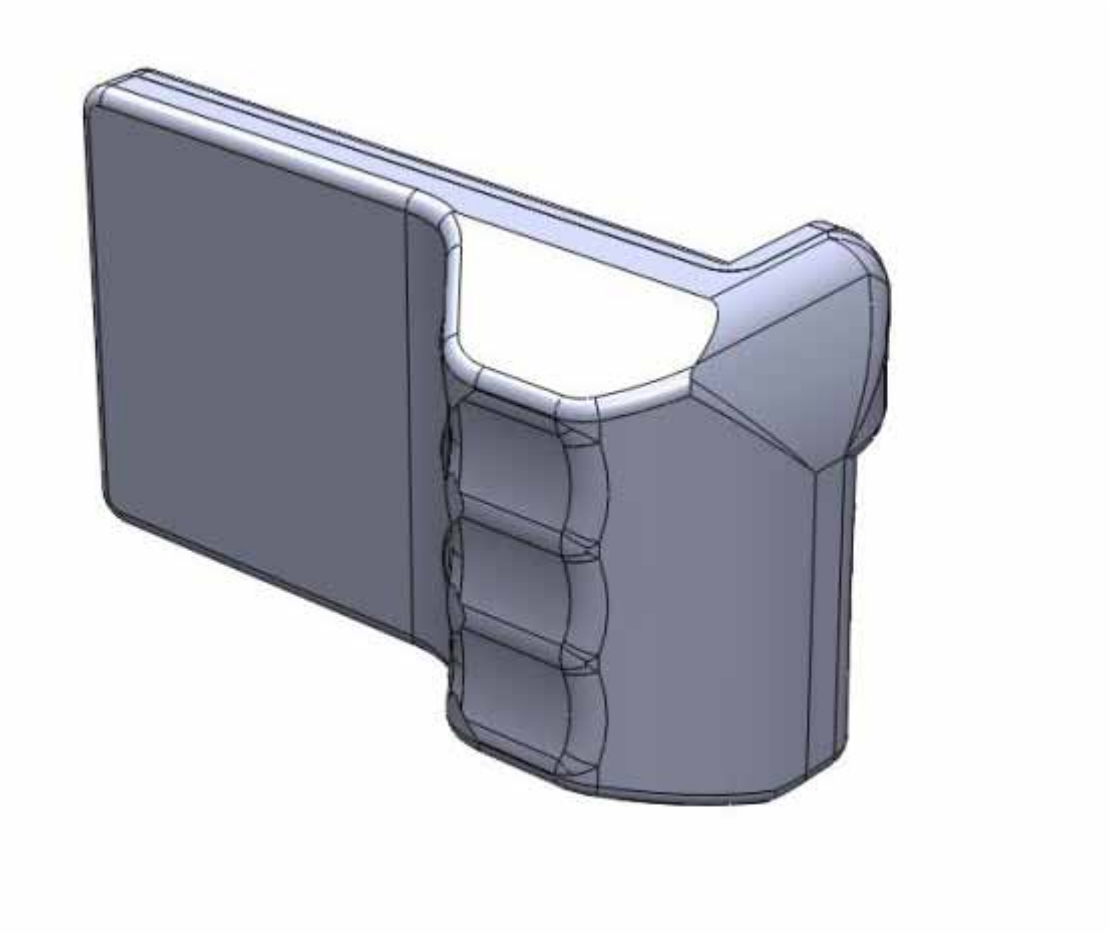


Figure 15-10-01 – Clip-on Rechargeable Battery – Rear View

15-10-02 Attaching the Custom Battery

For increased portability, the unit can be powered by the custom NanoVue clip-on rechargeable battery pack, which provides between 4 and 5 hours continuous battery life.

16-Troubleshooting

16-00 General

Many problems can be isolated with this general technique: Check connections and wiring harnesses recheck all connections to the unit for security. Check all harness runs for possible pinching. Recheck all pin outs for application security.

16-10 Power Trouble

Problem	Possible Cause	Solution
No displays	No Power supply	Verify unit is properly connected to power source Verify battery has sufficient voltage

16-20 Payload System Trouble

Try to establish which element of the Payload System is giving the problem.

16-21 Video Trouble

Problem	Possible Cause	Solution
Blue screen at receiver	No Tx video	Check video is enabled at the transmitter.
	Service Name	Check correct unit name is selected at the receiver to match the transmitter.
	Encryption	Check scrambling keys are matched.
	Guard Interval	Check the guard interval and bandwidth match the transmitter.
	Licence	Check the unit is licensed appropriately.
Reduced Image Quality	Horizontal Resolution	Image quality is affected by the selected horizontal resolution at the transmitter. The image will become progressively softer

		for each horizontal resolution below the sharpest resolution of 704 pixels. It is advisable to select a horizontal resolution that matches the resolution of the camera.
	Video Bitrate	Image quality is also affected by the video bit rate (which can be read from the video bit rate field of the SOLO transmitter controller). The standard setting is 2.3Mb/s. However enabling audio, particularly the high quality audio modes, will reduce the video bit rate substantially. Therefore ensure an appropriate audio mode is selected or audio is fully disabled if not required.
Rolling black and white distorted video	Wrong video standard	Check that the transmitter **Video Input** is set to the correct video standard.

16-22 Audio System Trouble

Problem	Possible Cause	Solution
No audio	Not enabled at transmitter Only MPEG layer1 48 kHz and MPEG layer2 48 kHz modes are supported.	Ensure audio is enabled at the transmitter (disabled by default).

16-23 Data System Trouble

Problem	Possible Cause	Solution

16-30 Control Application System Trouble

Problem	Possible Cause	Solution
Cannot browse to NanoVue control application when plugged into laptop.	Laptop and/or NanoVue has DHCP enabled.	Disable DHCP on laptop and NanoVue and assign fixed IP addresses.

16-40 IP System Trouble

Problem	Possible Cause	Solution

16-50 Antenna System Trouble

Problem	Possible Cause	Solution

16-60 RF Link Trouble

Problem	Possible Cause	Solution
No RF Link	No transmitter	Check a suitable transmitter RF source is active, on correct frequency.
	No antennas	Ensure antennas are connected to the unit and are within the correct frequency range.
	Interference	Ensure there is no interfering signal.
Poor Link Performance	Interference	Should an interfering RF signal occur on the same frequency the performance of the link will be affected. Remove the interferer or move to an alternative frequency.
	Unsuitable or out of band antennas	Change antennas
	Reduced Transmit power	Ensure that the attenuation setting on the transmitter is appropriate for direct output, or for amplifiers connected.

16-70 Encryption System Trouble

Problem	Possible Cause	Solution

16-80 Indicating System Trouble

Problem	Possible Cause	Solution

Appendix A-Glossary

A-00 General

The glossary contains some abbreviations and terms you'll need to know.

A-10 Glossary

A	Means...
AC	**Alternating Current.** Current that is continually changing in magnitude and periodically in direction from a zero reference level.
AES	In cryptography, the **Advanced Encryption Standard** (**AES**) is an encryption standard adopted by the U.S. government. The standard comprises three block ciphers, AES-128, AES-192 and AES-256, adopted from a larger collection originally published as **Rijndael.** Each AES cipher has a 128-bit block size, with key sizes of 128, 192 and 256 bits, respectively.
Amplification	The process of increasing the strength (current, voltage or power) of a signal.
Amplitude	The level of an audio or other signal in voltage or current. The magnitude of variation in a changing quantity from its zero value.
Amplitude Modulation	Modulation in which the amplitude of the carrier wave is varied above and below its normal value in accordance with the intelligence of the signal being transmitted. Also called AM.
Analogue	**Analog transmission** is a transmission method of conveying voice, data, image, signal or video information using a continuous signal which varies in amplitude, phase, or some other property in proportion to that of a variable.
Antenna	An **antenna** (or **aerial**) is a transducer designed to radiate or receiver electromagnetic energy (generally RF).
Antenna Bandwidth	The frequency range over which a given antenna will accept signals.
Antenna Gain	The effectiveness of a directional antenna as compared to a standard non-directional antenna. It is usually expressed as the ratio in decibels of standard antenna input power to directional antenna input power that will produce the same field strength in the desired direction. For a receiving antenna, the ratio of signal

A	Means...
	power values produced at the receiver input terminals is used. The more directional an antenna is, the higher is its gain.
Attenuation	Power loss resulting from conductor resistance and dielectric loss within the insulating material used to separate the conductors.
ASI	**Asynchronous Serial Interface**. A streaming data interface which often carries an MPEG Transport Stream. An ASI signal can carry one or multiple SD, HD or audio programs that are already compressed, not like an uncompressed SD-SDI (270Mbs) or HD-SDI (1.45Gbs). An ASI signal can carry varying amounts of data but is always padded to run at a fixed line rate of 270 Mb/s.

B	Means...
BNC	**Bayonet Neill-Concelman –** A very common type of RF connector used for terminating coaxial cable.
Bandwidth	The width of a band of frequencies used for a particular purpose.

C	Means...
COFDM	**Coded Orthogonal Frequency Division Multiplexing** is a frequency-division multiplexing (FDM) scheme utilized as a digital multi-carrier modulation method. A large number of closely-spaced orthogonal sub-carriers are used to carry data.

D	Means...
Digital	A **digital signal** is a discontinuous signal that changes from one state to another in discrete steps.
Decibel	The standard unit used to express transmission gain or loss and relative power levels. Also written as dB.
Demodulate	To recover the information originally impressed on the radio wave.

E	Means...

Electromagnetic field	The field of force that an electrical current produces around the conductor through which it flows.
Electromagnetic Waves	A wave propagating as a periodic disturbance of the electric and magnetic fields and having frequency in the electromagnetic spectrum; the means by which energy is transmitted from one place to another.

F	**Means...**
FEC	**Forward Error Correction** is a system of error control for data transmission, whereby the sender adds redundant data to its messages, also known as an **error-correction code**. This allows the receiver to detect and correct errors (within some bound) without the need to ask the sender for additional data. The advantage of forward error correction is that a back-channel is not required, or that retransmission of data can often be avoided, at the cost of higher bandwidth requirements on average. FEC is therefore applied in situations where retransmissions are relatively costly or impossible.
FOV	**Field of View -** The field of view (also field of vision) is the angular extent of the observable world that is seen at any given moment.
fading	A periodic decrease in received signal strength
Frequency	The rate at which a process repeats itself. In radio communications, frequency is expressed in cycles per second. Signals also have a property called wavelength, which is inversely proportional to the frequency.
Frequency Modulation	The process of varying the frequency of a carrier wave, usually with an audio frequency, in order to convey intelligence. Also called **FM**.

G	**Means...**
GHz	**Gigahertz** - One gigahertz is equal to 1,000 megahertz (MHz) or 1,000,000,000 Hz.
Gain	The increase in signal strength that is produced by an amplifier.

H	**Means...**
Hertz	One cycle per second.

I	Means...
IR	**Infra Red** - Infrared (IR) radiation is electromagnetic radiation whose wavelength is longer than that of visible light.
Impedance	The total opposition offered by a circuit or component to the flow of alternating current.

L	Means...
LOS and NLOS	**Line-of-sight** propagation refers to electro-magnetic radiation including light emissions travelling in a straight line. The rays or waves are diffracted, refracted, reflected, or absorbed by atmosphere and obstructions with material and generally cannot travel over the horizon or behind obstacles. NLOS is Non Line-of-sight.
Load	A device that consumes electrical power.
Lux	The **lux** (symbol: **lx**) is the SI unit of illuminance and luminous emittance. It is used in photometry as a measure of the *apparent* intensity of light hitting or passing through a surface.

M	Means...
MHz	**Megahertz** is equal to 1,000,000 Hz
mW	**Milliwatt** - The milliwatt (symbol: mW) is equal to one thousandth (10^{-3}) of a watt.

N	Means...
nm	A **nanometre** (American spelling: **nanometer**; symbol **nm)** is a unit of length in the metric system, equal to one billionth of a metre (i.e., 10^{-9} m or one millionth of a millimetre).
Noise	Random pulses of electromagnetic energy generated by lightening or electrical equipment.

O	Means...
Omni directional antenna	An antenna whose radiation pattern shows equal radiation in all horizontal directions.

Oscillation	A periodic, repetitive motion or set of values (voltage, current, velocity).

P	**Means...**
PIR	**Passive Infra Red** sensor (PIR sensor) is an electronic device that measures infrared (IR) light radiating from objects in its field of view.
Propagation	A phenomenon by which any wave moves from one point to another; the travel of electromagnetic waves through space or along a transmission line.

R	**Means...**
Rx	**Receiver**, an electronic device that changes a radio signal from a transmitter into useful information.
Radiate	To transmit RF energy.
Radio Frequency	Any frequency of electrical energy capable of propagation into space (usually above 20kHz). Also called RF.

S	**Means...**
SNR	**Signal to Noise Ratio** is an electrical engineering measurement defined as the ratio of a signal power to the noise power corrupting the signal. Signal-to-noise ratio compares the level of a desired signal (such as music) to the level of background noise. The higher the ratio, the less obtrusive the background noise is.
Signal	In electronics, a signal is an electric current or electromagnetic field used to convey data from one place to another. The simplest form of signal is a direct current (DC) that is switched on and off; this is the principle by which the early telegraph worked. More complex signals consist of an alternating-current (AC) or electromagnetic carrier that contains one or more data streams.

T	**Means...**
Tx	A **transmitter** is an electronic device which, usually with the aid of an antenna, propagates an electromagnetic signal such as radio, television, or other telecommunications.

TNC	The TNC (threaded Neill-Concelman) connector is a threaded version of the BNC connector. The connector has a 50 Ω impedance and operates best in the 0–11 GHz frequency spectrum.

U	**Means...**
USB	Universal Serial Bus

V	**Means...**
VHF	**Very High Frequency** – 30 MHz to 300 MHz
V	Volt
Viterbi	The process of decoding forward error correction in the decoder.

W	**Means...**
Watt	The **watt** (symbol: **W**) is a derived unit of power in the International System of Units (SI). It measures rate of energy conversion. One watt is equivalent to 1 joule (J) of energy per second.
Waveform	Signal shape
Waveguide	A specially form hollow metal tube, usually rectangular in shape in cross section, used to connect a High Power amplifier to the antenna.